THE ELECTRICAL WORLD

A Weekly Review of Current Progress in Electricity and its Practical Applications

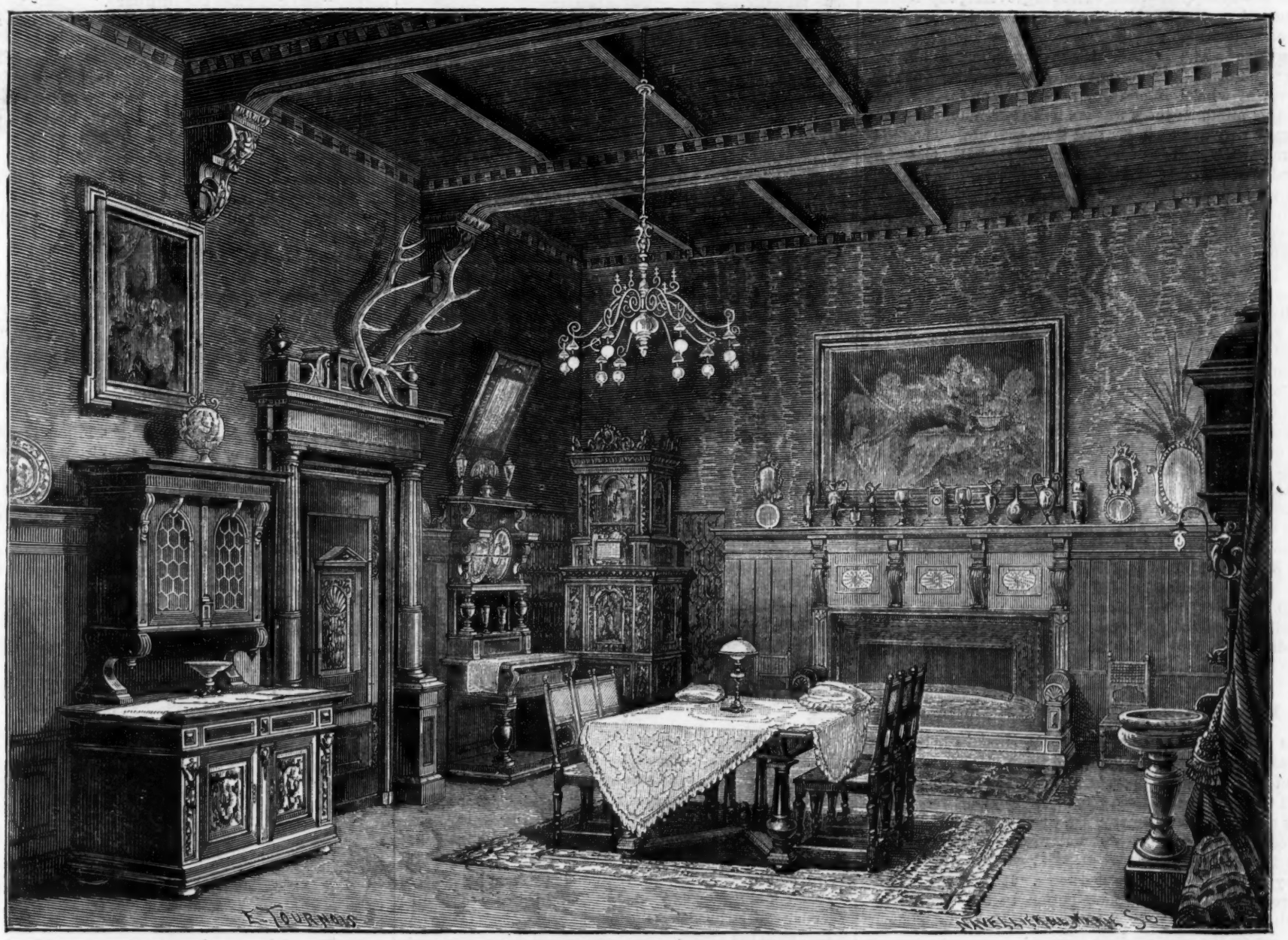
VOL. II.—No. 14. NEW YORK, DECEMBER 1, 1883. $2 PER ANNUM. 5 CENTS A COPY.

The Incandescent Light in Interior Illumination.

The city of Munich being the home of a whole world of artists and art workers, it is only natural that its atmosphere should be replete with artistic taste and artistic zeal. Our leading articles of Sept. 8 and 15 evinced this by showing how much attention was bestowed on artistic effects of all kinds at the electrical exposition held there last year. But the love of art of this community of artists did not stop here. It is true that this exposition, like that held at Paris the year before, had in view the more practical and scientific object of affording opportunities for practical study and comparison of the ways and means of employing electricity for the diverse purposes to which it is applied. Nevertheless the occasion was not to be neglected by those whose very calling is the search of the beautiful and the ideal. They wished to get the fine and admirable effects which taste and skill can combine so as to show the electric light at its best. In a word, it was not enough that the designer and metal worker had demonstrated their ability to make the incandescent light ornamental. The architect and the decorator of interiors needs must show what they can do by way of harmonizing. The incandescent light was for them only a kind of *chiaro oscuro* in whose soft, mellow illumination they could "paint" realistic scenes, by the careful and harmonized assemblage of rich furniture and decoration. It was a new type of "*genre*" sketching, so to speak, intended both as a test and as a demonstration of the adaptability of the incandescent electric light to interior illumination.

To facilitate this study of the different effects obtainable by the incandescent electric light, a number of apartments or "boxes" on the sides of the Crystal Palace had been arranged in such a way as to present the appearance of small rooms, in which the public could study the illumination obtained by the different kinds of incandescent lamps, under varying conditions. Each of these apartments differed from the rest, and elicited renewed admiration so exquisitely arranged it seemed. The most delicate taste was manifested in the selection and arrangement of the furniture for each apartment and the incandescent lamps were disposed in each case with special reference to the effect desired.

All varieties of combinations were offered to the admiration of the visitor. Here a salon with gay colors and ornaments glittering in the flooding light. There, a reception room, furnished and ornamented in the highest style of the sculptor's and carver's art. In this case the illumination evinced a most careful and conscientious study of effects in determining the color, number and disposition of the lights. To bring out these marvels of art into perfect relief requires, not a bold and general illumination, but a mild and subdued light that is so directed as to make a play of lights and shadows, but yet sufficiently disseminated to tone down the deeper shadows. To give our readers an idea of the care with which every detail was attended to in order to secure perfect harmony in these apartments, we reproduce from our contemporary, *La Lumière Electrique*, an illustration of a dining room with oak furniture, *renaissance* style. The furniture was indeed very beautiful, and was contributed by M. Passenbacher, purveyor to the court, who had sought, by giving attention to the minutest details, to reproduce exactly the appearance characteristic of a dining room of this epoch. The carved woodwork in the casements and transoms and the traditional hart's horns, over the massive doorway are very suggestive of that time. The windows were adorned by beautiful colored glass designs from the studio of M. A. Zeller, painter to the court, but were not sufficiently lighted from outside to show all their beauties, and the attention of the visitors rather lent itself to the admiration of the numerous pieces of gold and silver ware of the jewels and the collection of ornaments, all of the same epoch, which M. Rottmanner had exhibited. The illumination in this case was produced by means of a chandelier of ten lamps suspended from the centre of the ceiling and two side lights, but it



A DINING ROOM LIGHTED BY INCANDESCENT LAMPS.

must be admitted the light was rather sombre, and of itself was scarcely sufficient to disclose the excellent beauties of this improvised dining-room of a former century to the best advantage. It was only by day, with the assistance of the diffused sunlight, that they could be adequately appreciated. The rays of the arc lights around at night entering through the open archway did add to the general illumination, but the ghastly w hiteness did not blend well with the delicate yellow of the incandescent lights, and produced contrasts of color on the furniture which detracted somewhat from the effect realized. With the addition of a few more side lights the defect, slight though it was, would have been corrected.

This miniature exhibition of the incandescent light under varied conditions proved to all how applicable it was to the purpose of interior illumination, not only as a factor of decoration, but as a means of bringing into relief the decorations, ornaments and other attractive features of the apartment itself. There is much that the visitor could learn there that will prove suggestive in real installations, and at the same time the companies who are interested in the manufacture and sale of their apparatus can also find this a good opportunity to consult the tastes of their patrons.

The Seventh "Magnetic" Sense.

Have all the senses with which our flesh is endowed been determined and counted? Sir William Thomson, the eminent professor of mathematics in the University of Glasgow, in his inaugural address, delivered last week, says the *British Medical Journal*, as president of the Midland Institute, at Birmingham, broached the idea of the existence of a magnetic sense. This sense he called the seventh sense, to distinguish it from our other six senses—namely, those of sight, hearing, taste, smell, heat and force. He said that, in speaking of a possible magnetic sense, he in no way supported that wretched groveling superstition of animal magnetism, spiritualism, mesmerism or clairvoyance, of which they had heard so much. There was no sense of a mystic kind. Clairvoyance, and so on, was the result of bad observation chiefly, mixed up with the effects of willful imposture, acting on an innocent and trusting mind. If there was not a distinct magnetic sense, it was a very great wonder that there was not. The study of magnetism was a very recondite subject. One very wonderful discovery was that made by Faraday and worked out very admirably by Foucauld, an excellent French experimenter, showing that a piece of copper or a piece of silver let fall between the poles of a magnet would fall down slowly, as if through mud. Was it conceivable that if a piece of copper could scarcely move through the air between the poles of an electric magnet, a human being or living creature in the same position would experience no effect? Lord Lindsay got an enormous magnet, so large that the head of any person wishing to try the experiment could get well between the poles; and the result of the experiment was marvelous, the marvel being that nothing was perceived. Sir William Thomson, however, was not willing to admit that the investigation was complete. He could not but think that the quality of matter in the air which produced such a prodigious effect on a piece of metal could be absolutely without any perceptible effect whatever on a living body. He thought the experiment was worth repeating, and it was worth examining whether or not an exceedingly powerful magnetic force was without perceptible effect on a living vegetable or animal body. His own speculation had led him to conclude that there might be a seventh or magnetic sense; and that it was possible an exceedingly powerful magnetic effect might be produced on living bodies that could not be explained by heat, force or any other sensation.

The N. E. Weston and the Edison Companies.

In our last issue we published a statement made by Grant Brothers, of Olneyville, R. I., and the N. E. Weston Co. in refutation of certain charges made by the Edison Co. At that time, we learned that the New England representative of the latter company, Mr. Spencer Borden, had prepared a rejoinder, but it was not ready for publication on the 24th ult., although we tried to get it. Since then a copy of it has been forwarded to us. It is far too long for reproduction, but, as a contribution to the controversy, ought to be obtained by any persons interested. The part bearing on the question is as follows:

"We beg to state that we have no controversy with Messrs. Grant Bros., who have merely allowed themselves to be used for advertising purposes by the vendors of the Maxim apparatus.

"That the test of the apparatus at their mill is utterly worthless becomes apparent when attention is called to the fact that no photometric test accompanied the indication of horse-power. The writer of the present communication states, from personal observation, that the lamps at Grant Bros.' mill do not average 12 candles power of average illumination, nor do the Maxim lamps at the station of the Rhode Island Company, in Providence, nor those on the Jersey City ferry-boats, nor did those at the New England Manufacturers' and Mechanics' Institute at Boston.

"The United States, Weston, or Rhode Island Company never installed a plant of Maxim lamps that would run seven to the horse-power, the lamps having an average circular illumination of 16 c. p., and a life of 600 hours.

"When the public are informed that the relative life of incandescent lamps is in the *inverse ratio of the fourth power* of their incandescence, the "business methods" of those who would obtain and publish a statement from gentlemen, who, however skilled and successful as manufacturers, are unable to know whether lamps are at the candle-power claimed when a test is made, can be appreciated."

After all, when the field for conquest is so large and gives such generous elbow-room for the various systems, is it not a pity that the companies should devote their energies to this fruitless kind of strife?

Housekeeping by Electricity.

A suggestion comes from Philadelphia for the application of co-operative principles to family cooking. The idea is to have meals supplied to houses through pipes, like gas and steam. The dwellers in a block are recommended to combine, and erect in the centre of their square a common kitchen of sufficient capacity to supply all their wants. This kitchen is to be connected with each house by covered steam-pipes large enough to admit for passage a covered and heated car, in which the food can be placed. By means of the telephone, a housekeeper can order the kind of dinner desired, and when the dinner hour arrives, all she will have to do will be to turn a stop-cock and have the food shot, piping hot, right upon the table. This would dispense with Bridget's services in the kitchen, and would afford many other reliefs which have long been desired in every household. If the head of the house objected to the breakfast coffee, or to the cooking of the dinner, instead of making himself disagreeable about it in the family circle, he could step to the telephone and "blow up" the cook. The fact that the cook was at a distance would add to the relief thus afforded, for it is much easier to call a person disagreeable names through a telephone than in his immediate presence.

But the most welcome gain of all would be the respite from household cares which the system would bring to the woman of the house. She would not have to go to market, and would be spared the periodic struggles with the cook for the control of her own premises. This is where the proposed reform is likely to secure its greatest favor. The "want" of the period is a system of housekeeping which has no burdens of any kind. Hotel life does not meet it, because, while it gives relief from household cares, it does not furnish any of the blessings of home life. The great apartment houses, with restaurants attached, come nearer to it, but there are defects in their systems. Why should not the Philadelphia idea be enlarged and applied to all the principal demands of housekeeping? If meals can be sent through pipes, why stop there? The block kitchen might be enlarged into a central reservoir. If a fire of coals was wanted, a pipe might be connected with the back of the grate, and a ready-made fire might be dumped into it in a twinkling, with none of the usual concomitants of shavings, kindling-wood and dust. By another pipe the ashes might be returned by simply touching a spring. So, also, in the matter of servants. A supply could always be kept on hand at the reservoir, and a ring of a bell might bring a chambermaid, a porter, or a waitress. Housekeeping would thus be reduced to a system of pipes and electric bells.—*N. Y. Evening Post.*

An Electrical Phenomenon.

At Espelny the Count de Lus has a locomotive which drives a threshing machine by means of a leather belt some metres in length. Standing near the belt, and to protect him from the heat of the fire, he one day held open a parasol which had a wooden handle and a frame or bracing, made, as usual, of iron. Happening to touch one of the braces he immediately experienced a sensible electric shock.

The following day I repeated the experiment and obtained sparks about three-fourths of an inch long, following each other so rapidly as to indicate an almost continual current, the intensity of which seemed to depend upon the rapidity with which the belt moved. When the engine worked very rapidly, strong sparks escaping from the belt to the boiler produced a cracking noise, which could be distinctly heard, though the light prevented them from being seen.

How could this be explained? Could it be attributed to electricity delevoped by the evaporation of water in the boiler, as in the hydro-electric machine of Armstrong? No, because the boiler of Armstrong's machine must be mounted on insulating pillars of glass, while in this case, on the contrary, the iron wheels of the locomotive rested upon and formed a communication with damp ground.

The explanation, which seemed to me satisfactory, is the following: The belt was not sufficiently tight, and the engineer resorted to the common expedient of powdering it with rosin in order to increase its adhesion to the driving wheel and pulley. Still the adhesion was not perfect, and by the friction between the pulley and belt, as in the usual electro-phorous, the two fluids were separated. The frame of the parasol acted the part of a condenser, and as the belt was about ten yards long and one-fourth of a yard wide, it presented a superficial area of about two and one-half square yards, upon which a considerable quantity of free electricity could be accumulated. I had no means of determining the species of electricity, but I think it was resinous.—*J. M. Folache in Nature.*

The Telephone Better Than the Sheriff.

We find in the *Brooklyn Eagle* the following narrative of the manner in which an astute lawyer was enabled by means of his telephone to collect a bad debt for one of his clients and dispense with the services of the sheriff:

A lady entered the office of a law firm on Montague street and consulted Mr. P., the junior partner, as to how she should act in a difficulty. She had rented half of her house to Mr. W., who had cleared out, owing her $200 for rent. He had removed with the intention of going to Bridgeport, and his furniture was on the way to the boat, which was to leave shortly for the Connecticut town. Mr. P. immediately prepared the necessary papers and got an attachment. A clerk was dispatched to New York with directions to put the attachment in the hands of the sheriff at once and to search the river front for the furniture. The lady departed, and Mr. P. awaited developments. An hour later Mr. W. entered the lawyer's office. He wore a nonchalant air. He carried his hands in his pocket and a cigar in his mouth.

"I understand," said he to Mr. P., "that you are trying to seize my property."

"You are the man, I suppose," Mr. P. answered, "who hired Mrs. Blank's house and quitted without paying the rent, and are removing your furniture to Connecticut?"

"That's about the size of it," Mr. W. said, "and I thought I would just step in and ask whether you had got my property yet?" Then he laughed gayly as one who had made a pleasant joke.

At that moment there came a ring at the telephone. Mr. P. jumped up and responded with the usual hello.

"Who's that?" came back.

"I—P.," was the answer, Mr. P. recognizing the voice of his clerk, who had gone over the river with the attachment,

"We've hunted everywhere," came through the telephone, "and can't find the furniture."

Mr. P. turned to Mr. W. and said: "What are you going to do about it?"

"In the first place," Mr. W. replied, "I want to know whether you've got my furniture—ha, ha!"

"Tell the sheriff," said Mr. P., with his lips to the telephone, "to take the furniture off the boat and put it in a storehouse."

"Hold, there!" Mr. W. exclaimed, his tone of jubilant banter changed to one of genuine alarm: "I don't want the furniture taken off the boat."

"Well, what shall we do," Mr. P. said, "you hear my orders?"

The telephone bell rang violently.

Mr. P. put his ear to the funnel and heard these words delivered with great distinctness and emphasis: "I-tell-you-we-haven't-got-the-furniture; we-can't-find-it."

"I don't care if the sheriff's fees are $50," Mr. P. shouted in return through the instrument; "the defendant has to foot the bill. Store the furniture at once."

"Look here, Mr. P." the defendant said in a tone of supplication, "what's the best I can do?"

The bell rang again furiously. Mr. P. put his ear to the tube, and the speaker said in tones which Mr. P. recognized as those of a clerk in the sheriff's office: "Blank, blank you, what do you mean? Are you crazy? Don't you hear? We haven't got the blank, blank furniture, and we don't know where it is."

"Just so," replied Mr. P. "Do the best you can, and damage it as little as possible. The defendant will have to stand the expenses."

"Now don't be severe," Mr. W. said, almost in despair; "tell me what you demand?"

"Pay the full amount due," replied Mr. P., "and we'll throw off the costs and expenses."

The bell rang again with louder tones than before. Mr. P. listened. The voice that last answered said:

"I'll be blank blanked if I ever came across such stupidity. Hold on and I'll spell it out to you."

And then carefully, letter by letter, the voice spelled out: "We haven't been able to find the furniture."

The defendant by this time had got out his pocket-book, and was counting out the bills. When he had paid the $200, Mr. P. went to the telephone and called up the sheriff's once more.

"Now then, stupid, what's the matter?" was the reply.

"Give the sheriff directions to let the furniture go," Mr. P. said.

Then he sat down and wrote a receipt. The bell went off again like mad. Mr. P. coolly placed his mouth to the telephone and said: "Say, tell the sheriff to let the furniture go and send on his bill for the fees."

Then Mr. P., with a smile on his face, listened for a reply. "Blank blank you, you thick-headed ass," came over the wires into Mr. P.'s ears, "we haven't got the property."

Then Mr. W. quitted the office. Mr. P. rang up the sheriff's, and received a complimentary reply. Then it was Mr. P.'s turn. "While you were bellowing over the wires," he said, "the defendant was by my side, and I had to make the proper answers to bring him to terms. Anything stupid or like an ass in that? Send over your bill, the suit's settled."

STRANGE, BUT TRUE.—An exchange thinks it singula that electric light companies should be so largely composed of heavy men.

Gelatinized Fibre.

In constructing electrical apparatus there is one important requirement to be met—insulation—which influences greatly the selection of the material to be used. In every case there are certain definite predetermined paths or circuits which the currents are to follow in performing the function of the apparatus. To prevent accidental contacts and diversions, we must therefore have recourse to insulating materials. But if now we consider the multiplicity of situations and the variety of conditions under which these materials are to be used, it becomes evident that they require additional qualities in order to be generally adaptable. In many cases, for instance, the very material which is to provide for the insulation must also form the general structure that holds the parts of the apparatus in their respective places. Evidently it must be of a nature that not only admits of being easily and readily adapted to the purpose in hand under the artisan's tool, but it must possess other qualities which shall determine a long period of durability. Glass, for instance, is an excellent insulating material, but it does not admit of being worked readily. Moreover it is so brittle that it requires rather careful handling—a circumstance that would debar it from general use, even were it not so liable to damage from sudden changes of temperature. Outside of the manufacture of telegraph line insulators, and a few similar purposes, its use is quite limited. Hard rubber has of late years come into vogue as a constructive insulating material, and it presents important advantages over glass. It can be readily worked, and is not so easily damaged. But it is costly, and besides is not entirely devoid of brittleness. It is also liable to soften and disintegrate under the influence of heat, and of course it is not for this reason so well applicable to apparatus wherein strong currents are used, since heat is a probable consequence in such cases. Wood has been resorted to in some cases, but for certain purposes, while it can be readily worked, it lacks in fineness and homogeneity of structure. The universal need of a cheap and readily adaptable insulating material has led to the production of a new substance, to which the name of "gelatinized fibre" has been given. This substance is of the nature of artificial leather board, and is made of compressed paper fibre or pulp of a special kind. The pulp is prepared or treated by a special chemical process, and it assumes a certain "gelatinized" form. This is subjected to an enormous pressure, and the result is a compact, dense material resembling celluloid or tortoise shell in texture, though it is not transparent. It is pressed in sheets of various thicknesses, from $\frac{1}{32}$ to $\frac{3}{4}$ inch, and is manufactured of three colors—red, white, black. The thin sheets possess a surprising elasticity, while they remain exceedingly tough, so that the material will stand almost any amount of hard usage without breaking, in which respects it differs greatly from hard rubber, one of whose great faults is its tendency to break under the tool. The thicker pieces will stand hammering quite as well as a piece of hard leather. Gelatinized fibre is also pressed into blocks for a variety of purposes, and it is hoped that the manufacturers will succeed in manufacturing tubing out of it. Owing to its elasticity and hardness, with homogeneity of texture, it offers but little resistance to the artisan's tools. It can be sawed, drilled, turned in a lathe, stamped with ease and without fear of breaking. It can be tapped as readily as celluloid, and it leaves a clean, sharp thread. This makes it very desirable for small work, as, for instance, in the base of an apparatus where there is usually a multiplicity of binding-screws, fastening screws, contacts, etc.

Gelatinized fibre is a comparatively light material, its specific gravity being only 1.3 or scarcely one-sixth of that of brass or copper. As an insulator it is practically as good as hard rubber, and it has not the disadvantage of being affected by heat. On the contrary, it is quite incombustible, as we have determined by experiment. It has been known to absorb moisture and swell a little when placed in hot water, but it will soon return to its normal state and will be as hard and dry as ever. Its lasting qualities are very great, and instead of decaying and disintegrating with age it appears to improve. It is susceptible of a very high polish, and it may be finished in the most approved style of the decorator's art if desired. The black gelatinized fibre when polished resembles fine hard rubber so closely that it deceives even those who ought to know. Its cost is hardly one-third that of rubber, so that it would be deserving of the attention of electricians and all who make use of insulating materials, even on the score of economy, without taking into consideration its many points of superiority. Although it has not been in the market very long, it has already been applied to innumerable purposes for which hard rubber and oftentimes wood were heretofore employed. We can testify by personal experience to its excellence and adaptability as a constructive and insulating material, and to show further its wide range of usefulness, we need only mention its use in electric lighting apparatus for many purposes, in switch-boards, switches, plugs, magnet-bobbin discs, press buttons, the bases of telegraph instruments. Only last week, while going over one of the largest electrical factories in New York, we saw great quantities of this material in readiness for use, after having been fashioned in many ways. At the Chicago Exposition of Railway Appliances last May, Messrs. Courtenay & Trull, 17 Dey street, New York, who control the sale of gelatinized fibre, made a comprehensive and interesting exhibit of apparatus, showing its utility for purposes undreamed of in electrical and even in mechanical construction. We have also been shown many of these beautiful specimens of what can be done with gelatinized fibre at the office of Messrs. Courtenay & Trull, who are always pleased to display them and to explain the merits of gelatinized fibre. As a further proof of the merits of this substance, we were informed that the capacity for its production has been quite severely taxed by the largely increasing demand.

On the Reducing Action of Spongy Lead.

The inquiry into the nature of the local actions taking place in storage batteries has led to a detailed study of the reactive power which finely-divided lead can exert over different substances. We find in the *Journal of the Chemical Society* the following account of some recent experiments by J. H. Gladstone, F. R. S., and Alfred Tribe, F. C. S., whose combined researches on this subject have proved so interesting and valuable: In our recent experiments upon lead and lead peroxide batteries, we were desirous of ascertaining whether spongy lead, perfectly free from hydrogen, was capable of reducing such salts as nitrate and chlorate of potassium. For this purpose spongy lead was prepared by precipitating the metal from the acetate by means of zinc, taking care that the salt was always in excess. It is difficult to imagine that lead prepared in this way should contain any occluded hydrogen. Nevertheless, it somewhat quickly reduced nitrate to nitrite of potassium. This action was found to be accelerated by heat, and to be retarded by the presence of sulphuric acid. A minute quantity of ammonia was also produced, especially when sulphuric acid was present or a high temperature employed.

In each of the experiments, the results of which are set out in the following table, 50 grams of spongy lead were employed and 200 c. c. of a 5 per cent. solution of nitre. In experiments III. and IV. the nitre solution contained 1 per cent. of H_2SO_4.

EXPERIMENT.	Temperature.	Time.	Percentages (grams).	
			KNO_3.	NH_3.
I.....	13°	1 hour	0.38	0.00005
I.....	13	24 hours	2.06	0.00015
I.....	13	48 "	2.43	0.00024
II.....	50	1 "	0.74	0.002
III.....	13	1 "	0.05	0.006
IV.....	50	1 "	0.13	0.003

Spongy lead has no action on an aqueous solution of potassium chlorate, but in presence of 1 per cent. of H_2SO_4 its reduction to chloride takes place slowly at ordinary temperatures.

The increased chemical activity of substances, when in a finely-divided condition, is to be generally accounted for by the greater surface exposed, and as a rule the actions brought about are similar in kind, but differ in degree. Spongy lead appears to form no exception. Ordinary lead filings were found to reduce nitre, etc., but very much more slowly.

Standard Time by Telephone.

The New England papers publish an interesting account of the new use to which telephones may be put, giving a subscriber to an exchange the right time of day. Simultaneously with the adoption of standard time came the introduction into practical use of the latest telephone improvement. Reduced to a plain statement, devoid of scientific phrase, any one with access to a Bell telephone in Boston can take his instrument from the hook and obtain the exact hour and minute of standard time during any minute of the 24 hours. It requires solely that the instrument shall be held to the ear and the pulsations counted. The ringing of the call will break the circuit and stop these pulsations, for when the instruments are being used for talking the current is taken from the "ground" and interrupted until the telephone has been replaced. The sound will resemble that of a fire-alarm signal. For illustration, a man may wake up some morning with a stopped watch. He would desire to reset his timepiece within a minute of the correct hour. To do this he will take off his telephone and will then hear, for instance, faintly, but distinctly, eight strokes, followed, after a second's pause, by nine. He will set his watch at 8.09 o'clock, and know that he is right by Cambridge time. This invention is the result of experiments by another Yankee in Texas, purchased by Mr. Loren N. Downs, the general manager of the New England Telephone company, and will be put in service on all lines managed or controlled by the Lowell syndicate, as a feature of the system, without extra charge to subscribers. To accomplish the work there is some additional outlay, but the expense is incurred by the telephonic management wholly for the benefit of telephone users. The automatic apparatus for the work is nearly completed by the Howard Watch Company. As soon as the requisite machines can be manufactured, this time system is to be extended throughout the entire New England circuits. In many repects the new service will prove advantageous.

Are Steam Locomotives Doomed?

We take the subjoined from the St. Louis *Republican:*

It's a success! What? Why, the electric railway system, an application of which Dr. Wellington Adams is the inventor, and St. Louis the cradle in which its infancy was nursed, and which will have reason to be proud of the vigor to which it will arrive. A reporter called upon Dr Adams yesterday in his machine shop at the top of the building on Third and Vine streets, and found the inventor engaged in explaining to some lady visitors the workings of the electric railway and in exhibiting the models of his cars, which he has now perfected and has in running order at his workshop. The model of the car, which embraces his invention, was upon the floor running upon brass tracks and connected with the place where the electricity is generated by means of copper conductors running between the tracks. This car is of light and airy construction, having but one door, and that at the side of the forward part of the car, opening upon the place where stands the genius of the train, who is at once conductor, brakeman and engineer. The car is lighted by electricity, the lamp and principle of the lamp being also inventions of Dr. Adams.

When the current was applied, the car moved along the track at the rate of about ten miles an hour and could be slackened, stopped or reversed at the will of the one holding the electric key. Near by was a car wheel of the size and construction such as are to be used upon the trains which the Doctor intends to run by his system. This wheel was of about the same dimensions as the ordinary car-wheel, being, however, a little bit more bulky in width and lacking that appearance of solidity and homogeneity possessed by the ordinary wheels of railway carriages.

In the wheel lies the secret of this invention, for herein are contained all the mechanical devices by which the subtle force is converted into a motive power upon principles as new as the devices which are employed.

Near by the track was a small compact arrangement of coils and wheels connected by a belt with an ordinary mechanic's lathe. This arrangement was the Doctor's electric engine, which can be used either as a power machine or to produce the electric light. Further along was another electric engine, which has been used as the sole source of power in the machine shop. This is the only place of the kind in the country where electric power is used in every one of the operations of the shop. Being asked by the reporter wherein were the salient differences between his system and those already in use in various places, Dr. Adams said that it would take a book, and a large one at that, to answer the question. Primarily the differences lay in the fact that by means of this system the item of locomotives was done away with, the many difficulties attendant upon the running of long trains were blotted out, the less wear and tear upon the tracks, and less expensive construction of the road, in the matter of bridges, culverts, etc., consequent upon the lightness of the coaches, and, above all others, the application of the power immediately to the place of traction, namely, the wheels.

The system contemplates the founding at various central stations of engines for the generation of electricity, which is conducted along between the tracks, taken up by an attachment to the car, communicated to the wheels and the circuit completed through the track. Each car is to run separately, having its own electrical appliances, and the conductor or engineer (who are one and the same), will be able to use, as motors, the power in one, two, three or four wheels at pleasure. The gain and preservation of power by means of this application to each wheel is incalculable. The amount of power used can be gauged to exactly meet the wants of the car, and, for general use, only one wheel will be necessary to be called into requisition.

Houses of Telephone Magnates.

Correspondents on all sides have been lately giving to the public some accounts of the millionaires of America, and their palatial residences. From Washington comes a description of what sort of houses may be built by the telephone. One on Connecticut avenue is owned by Mr. Gardiner G. Hubbard, who, ten years ago, as may be known, was a lawyer in Boston, with a fair practice. That learned profession does not, however, appear to have been as speedy an architect in raising such residences as the little instrument to which he has later directed his attention. His son-in-law, Professor Bell, has also a handsome residence in the same city. It is full of odd corners with windows here and there, giving a delightful irregularity, so much more agreeable to the eye than the stereotyped edifices, raised with painful sameness, and which are such a trial to the artistic mind.

BURNED IN EFFIGY AND ROTTEN-EGGED.—A dispatch of Nov. 27 from Ottawa, Can., says: "Hartley Gibson, Superintendent of the Government Telegraph, was burned in effigy and rotten-egged out of the town of Prince Albert, Northwest Territory, recently, for having broken faith with the residents of that town in placing a telegraph office three miles distant from that place. Telegraph poles which he had erected were torn up and ten lines destroyed. Six of the ringleaders have been arrested. All are prominent citizens.

THE
ELECTRICAL WORLD,
PUBLISHED WEEKLY AT
No. 9 MURRAY STREET, NEW YORK.

THE LARGEST CIRCULATION
Of any Electrical Journal in the World.

SUBSCRIPTION, IN ADVANCE, ONE YEAR, $2.00.

Postage to any part of the United States or Canada is always prepaid by the Publisher. Addresses changed as often as desired free. Always give the **old** as well as the new address.

TRANSIENT ADVERTISING RATES:

Outside page or first advertising page, per inch, each insertion...$2.00
Inside pages..... " " " " .. 1.50
Situations Wanted or Help Wanted, per insertion.....$1.00 to 2.00
Business Notices, per line..... 30

Liberal discount on large advertisements or on those running for some time.

Correspondence on all electrical subjects is solicited. Readers are cordially invited to communicate their views and opinions on all topics within the province of this journal. Items of information relating to any application of electrical science will be thankfully received. Our friends will render us a valuable service by forwarding news *promptly* as it occurs, and by mailing us marked copies of their local papers containing anything likely to interest readers of The Electrical World. All such matter should be kept separate from letters relating to the business department of the paper, and should be addressed to

"The Editor of The Electrical World, New York."

All communications relating to subscriptions, book orders, advertising, or of a business nature, should be addressed

W. J. JOHNSTON, Publisher,
No. 9 Murray Street, New York.

NEW YORK, DECEMBER 1, 1883.

CONTENTS.

ILLUSTRATED ARTICLE: Page.
The Incandescent Light In Interior Decoration..... 227
CORRESPONDENCE:
Lt. Fiske's Work on Electricity..... 231
REVIEWS OF NEW BOOKS:
"Philipp Reis, Inventor of the Telephone"..... 231
"Electricity as a Motive Power"..... 231
EDITORIAL:
The Electric Light in Workshop, Mill and Press-room.... 230
The Next Electrical Exhibition..... 230
The Lighting of Railway Cars..... 230
Electrical Energy In Washington..... 230
The Electrical Course at Cornell..... 230
Experiments with the Electric Furnace..... 230
MISCELLANEOUS:
The Seventh "Magnetic" Sense..... 228
The New England Weston and the Edison Companies.... 228
Housekeeping by Electricity..... 228
An Electrical Phenomenon..... 228
The Telephone Better Than the Sheriff..... 228
Gelatinized Fibre..... 229
On the Reducing Action of Spongy Leads..... 229
Standard Time by Telephone..... 229
Are Steam Locomotives Doomed?..... 229
Houses of Telephone Magnates..... 229
Another Trial of the Daft Motor..... 232
DEPARTMENTS:
The Telegraph..... 232
The Telephone..... 233
The Electric Light..... 233
Miscellaneous Notes..... 233
The Electrical World's Illustrated Record of Electrical Patents..... 234

NEW ADVERTISEMENTS.

The Consolidated Telephone Co.—Territorial Rights for Sale. 235
Brownlee & Co.—Cedar Telegraph Poles..... 235
The Electrical Supply Co.—"Electric Gas Lighting Department."..... 237
Bookhout Bros.—Engravers on Wood..... 239
E. & F. N. Spon and W. J. Johnston.—Philipp Reis, Inventor of the Telephone. Electricity as a Motive Power.. 240
W. J. Johnston.—New Year's Calling Cards for 1884..... 240
RE-ARRANGED ADVERTISEMENTS.
Viaduct Manufacturing Co.—Telephone, Telegraph and Electric Light Supplies..... 235
American Spiral Telephone Wire Co.—Spiral Telephone Wire..... 235

The Electric Light in Workshop, Mill and Press-Room.

In no place is good artificial illumination more imperatively needed than the workshop, the mill and the press room. All establishments of this kind are busy during the Fall, and the proprietors are now driven to the consideration of the best means of supplying their men with light. It may be claimed without any rashness, we think, that the electric light is in the greatest favor with them, and is rapidly superseding gas, on the ground of its efficiency, economy, safety and cleanliness. Manufacturers find that they derive more profit from the labor of their men when it is performed with the aid of the steady, uniform and powerful electric light than when they depend upon any other means of illumination; and the net gain, taking into account the improvement in the quality of the work, is large. An interesting tabular statement might be compiled if the materials were available, showing the great number of new factories and workshops throughout the country which have electric light installations, and the small number that are lighted by the dim, odoriferous oil lamps or by hot, unhealthy gas.

As might be expected, too, the light is found extremely advantageous in the press-rooms of large printing establishments, and there are now many printing and newspaper offices in which electricity supplies the illumination from the bottom floor to the top. Mr. J. W. Langston, in a note published by the Chicago *Inland Printer*, points out some special merits in the light as supplied by a Weston dynamo machine to the important map and directory house of Rand, McNally & Co. He emphasizes the well-known fact that where gas is used while doing color press-work, it is very difficult to get and keep the right tint. Yellow, green, blue and lighter shades of color give great trouble, and, in truth, as many of our readers are probably aware, these colors cannot be obtained with exactitude in a press-room where gas is the only illuminant. Where the electric light is used, as in the establishment named, the results are eminently satisfactory, not merely with regard to color printing, but in all the varied and delicate operations of making ready, overlaying, "bringing up" types or cuts that do not print properly, planing down rules that are too high, and the like. There are twenty-one presses in the firm's main press-room, but eight arc lights are found to suffice.

Taking a mill next, the superiority of the electric light over other artificial illumination is again made apparent. An Edison installation has just been completed in the Montauk Mill, Fall River, Mass. At this mill is manufactured duck of a very heavy quality in dark indigo, olive and blues, and it has been difficult to get a satisfactory light from the gas manufactured on the premises. Now, however, by placing one 16 candle-power lamp between every two looms, the owners of the mill have succeeded in getting just the light they want. This does but confirm the experience of many other mill proprietors all through the progressive manufacturing districts of New England.

In the Lehigh Valley car shops at Sayre, Pa., 161 Edison incandescent lights are used. The light is of sixteen candle-power, can be turned entirely or partially out, and is movable to any point desired by the workmen.

In view of the brilliancy and steadiness, the convenience and the almost absolute safety of the improved electric lamp, it is singular that even more of our large workshops do not avail themselves of the advantages it offers. Considering the matter from an economical standpoint, the following remarks, which we quote from the *Western Mechanic*, are timely and interesting:

"Of course, the primary object of shop illumination is to allow a longer day's work. Under the old-fashioned machine-shop régime, now generally in vogue, the men are provided with lamps, of disagreeable odors and uncertain light, which, being only useful when placed directly alongside the work in hand, are generally ten or twenty feet away when most needed. To the half-time additional wages for night work must, therefore, be added the loss of time in going after a lamp whenever needed; in groping about in the dark for monkey wrenches and other tools and in laboring under the disadvantage of never knowing exactly where the aid of the lamp will be next needed. It is a question of simple economy, therefore, whether a brightly lighted shop does not save money for the proprietors in the long run. Progressive manufacturers are beginning to see that it does; that more and better work can be accomplished by the men where they are not hampered by the restrictions above noted, and that, within reasonable limits, an illuminating plant is bound soon to pay for itself. Of course, however brightly the shop may be illuminated, however effectively shadows may be destroyed by counter-lights, some lamps will be needed to assist in work about the machinery; but the advantages of a steady, uniform and all-pervading light can scarcely be over-estimated. We are glad to know that the progressive spirit of the age has not stopped in our shops with the introduction of improved tools, but is extending also to the comfort and convenience of the workmen as well."

The Next Electrical Exhibition.

Considerable interest is already manifested in the electrical exhibition to be held under the auspices of the Franklin Institute at Philadelphia in September, 1884. It will be remembered that the exhibition has received the recognition of Congress. In accordance with the act passed by that body, providing for the admission into the United States, duty free, of all articles for exhibition only, Secretary Folger has issued a circular to collectors of customs and others relative to the exhibition of electrical apparatus, etc., to be held at Philadelphia by the Franklin Institute, in which he directs that invoicers of all articles imported for exhibition shall write the fact that the goods embraced therein are intended for the exhibition, and that each shipper shall be required to make his invoice in triplicate, giving a description of his goods, their value and the marks and numbers thereof; but any number of such invoices may be embraced in one declaration by the agent, such declaration to be taken before a consular officer of the United States and certified in the usual manner. Articles intended for this exhibition, and arriving at the ports of Boston, New York, Baltimore, San Francisco or New Orleans, or any port on the Canadian frontier, at which goods may be shipped for immediate transportation under the act of June, 10, 1880, may be shipped by bonded common carriers from the port of first arrival to Philadelphia. Such of the instruments of precision as may require verification and adjustment for adaptation to the scientific purposes of the exhibition in advance of its opening may be delivered to the Franklin Institute for such preliminary adaptation upon receipts signed by the president or vice-president of the institute.

The Lighting of Railway Cars.

In our issue of Nov. 10 we referred to the claim that the problem of electric lighting in railroad cars had been solved in England, and we gave some particulars in connection with the Cheeswright light, now in operation on two or three of the largest English railroads. Mr. W. Lachlan, whose name is associated with the earliest efforts in this direction, and who in 1881 fitted up successfully a Pullman car on the London, Brighton & South Coast Railway, has addressed an interesting letter on this subject to the *Journal of Railway Appliances*. After describing his experiments and discussing the relative merits of storage batteries and a dynamo driven from one of the axles of the car, the latter method having his preference, Mr. Lachlan sums up in an admirable manner the advantages of the electric light for this purpose. He names four great recommendations. The first is that electricity gives an absolutely steady light, unaffected by the wind, or by jarring from the opening of door or window, or by vibration of the train itself. The second is that the light is of a better color, and gives better illumination. The third is the important element in railroad travel, of safety; and the last is, superior healthiness. As to cost, Mr. Lachlan throws down the gauntlet boldly: "The cost of a system in which the storage batteries are carried on each car and fed at terminal stations would, on an extended scale, be much cheaper than gas. And with a self-producing system I believe the economy would be enormous, when once made to work automatically or nearly so."

In addition to the above, we note that on the 5:40 P. M. up express train from London to Leeds there are six Swan incandescent lamps, used to light the Pullman dining car. The electricity is derived from one primary battery of 12 cells. The size of the battery is as follows: Length, 4 feet; breadth, 8 inches, and depth, 8 inches. The battery is of zinc and carbon, with a new depolarizing arrangement, the details of which have not been made public. The light can be turned on and off at pleasure, and it can therefore be used in the daytime when the train is going through a tunnel.

Electrical Energy in Washington.

We learn from Washington that some gentlemen in that city propose to become incorporated into a company for the purpose of conveying electrical energy into every house in the capital, so that it can be applied for public and private purposes, for lighting and heating large buildings, for lighting, heating and cooking in private houses, for lighting the streets, and also for motive purposes in running machinery, street cars and vehicles generally. To this end they declare their intention of using the water power of the Potomac, now going to waste, by bringing that power up into the city, and there utilizing it. The gentlemen interested have an idea that this will all be done much more cheaply than by any other process of obtaining energy, and claim that while "the collector of the energy is a simple application of a known law," the conductor of the energy "will convey it without appreciable loss to any distance."

The Electrical Course at Cornell.

We have called attention to the fact that Cornell University would, upon the opening of its Fall term, receive students for instruction in electrical engineering, and have stated that several students availed themselves gladly of the opportunity thus afforded. The facilities provided appear to be excellent. Several rooms are specially equipped in a new building at the University for electrical tests and measurements, and all the important instruments for the purpose are furnished, while dynamo machines, systems of electric lighting and nearly all the leading applications of electricity are in practical operation there.

The course includes the use of instruments employed in making electrical measurements, with the means employed in testing their accuracy and determining their constants; the construction and testing of telegraph instruments; the methods of testing telegraph lines and cables; the theory, construction and testing of dynamo machines; the study of electric lighting; the determination of the efficiency of machines and motors, etc. The aim is to make the student do that which the engineer is required to do in active service. It appears that the requirements for admission are the same as attach to the other courses in technical subjects, namely, algebra and geometry in addition to the common English branches.

Experiments with the Electric Furnace.

That the electric furnace possesses great advantages is evidenced by a series of experiments made with one in Paris, an account of which we take from *L'Electricien* as follows: "Six pounds of forged iron were submitted for twenty minutes to the action of the arc, and the metal was then poured into a mold. It was found to be crystalline, and could not be forged. This difficulty may be

remedied by adding a little manganese before pouring out; but the reason of this action is not understood. Three-quarters of a pound of copper were melted in charcoal dust for an hour, at the end of which time all but three-quarters of an ounce had been vaporized." No disagreeable effects were perceptible in the atmosphere while this process was going on. The same account states that, "eight pounds of platinum were entirely melted in about a quarter of an hour. A half pound of powdered tungsten was submitted to the action of the electric arc, in a clay crucible. Very dense fumes escaped, and a cavity about a half inch deep formed at the summit. The metal appeared to have been melted to only a very slight depth below the cavity. The unmelted portion was covered with very beautiful crystals, which were evidently formed by the slow cooling of the distilled vapor. Various other experiments were tried with other metals.

Reviews of New Books.

PHILIPP REIS, INVENTOR OF THE TELEPHONE. By Silvanus P. Thompson, B. A., D. Sc. E. & F. N. Spon, London and New York, 1883. $3.

The controversy with regard to the priority of invention of the telephone has reached an important stage and is being carried on with great activity in THE ELECTRICAL WORLD and in the columns of a vast number of other journals of a scientific nature. Anything that relates to the question and that can be brought into the discussion has become of transcendent interest. In some quarters the controversy has narrowed down to a mere verbal quibbling, in others the opponents are so thoroughly established in their own convictions as to render unnecessary any further attempt to argue with them. To us it seems that this is one of those great questions upon which it is never too late to receive evidence, and, as was remarked on Oct. 6 in our editorial page: "The impartial and disinterested spectator who wishes to do true and full judgment in his decision is content to defer his judgment until the case is fully argued, so that his verdict, when it does come, may have no cause to appeal to a higher tribunal to be reversed." In short, we favor the allowance to the parties on either side of this controversy ample time in which to make the best presentation of their case that historical research and scientific knowledge will enable them to offer.

The parties to this war of words consist, on the one side, of several eminent electricians on this side of the Atlantic, while Professor Thompson leads the opposition on the other. In the little volume, whose title is given above, the professor has written a book embodying in systematic order most of his arguments on the subject, besides some other matter of a very interesting nature. The manner in which he has attacked the problem shows a large amount of minute investigation of facts bearing upon the subject, and goes far toward sustaining his reputation as a conscientious investigator.

The author devotes the first chapter of the book to a short but concise biography of Philipp Reis, giving the principal events and dates in his career, with particular reference to his connection with the telephone. It demonstrates anew the fact that a man's success in life depends upon his own efforts.

Considering the development of the telephone proper. Prof. Thompson very properly takes up the receiver and describes that first. Right here at the beginning, it is stated, of the ten or dozen instruments described, that, "theoretically, the last was no more perfect than the first, and they all embody the same fundamental idea; they only differ in the mechanical means of carrying out to a greater or less degree of perfection the one common principle of imitating the mechanism of the human ear and applying that mechanism to affect or control a current of electricity by varying the degree of contact of a loose joint in the circuit." Following this is a description of ten forms of Reis' apparatus, beginning with that made in imitation of the ear, and ending with what Prof. Thompson calls the "Square Box" pattern. All these instruments embody the same principle, which is "that of controlling the electric current by the voice working upon a point of imperfect contact, by the agency of a tympanum, thereby opening or closing the circuit to a greater or less degree, and so regulating the flow of the current." They present an interesting illustration of the development of the fundamental idea, and show a fostering spirit constantly present.

Reis' first receiver consisted of a knitting needle surrounded by a coil of insulated copper wire, and in order to amplify the vibrations induced in the needle, he fixed it in an upright position upon the sounding board of a violin. A later form of receiver consisted of an electro-magnet, which vibrated an armature connected with a sounding-board. Finally Reis returned again to the knitting-needle pattern, but instead of setting it on end upright, he supported it horizontally at both ends.

After thus describing all the forms of Reis' telephones, the author takes up the argument by stating that "the point at issue is not whether Reis invented *a telephone*, but whether Reis invented *the telephone*." The points which he seeks to prove are summed up in three propositions, which are:

I. Reis' telephone was expressly intended to transmit speech.

II. Reis' telephone, in the hands of Reis and his contemporaries, did transmit speech.

III. Reis' telephone will transmit speech.

These propositions are fully discussed in all their bearings, and documents and witnesses cited in proof of them.

This is supplemented by a chapter detailing in full all the documents and testimony of witnesses which were referred to in the argument. Among these we find extracts from the proceedings of several learned societies and a "Prospectus," or instructions which accompanied Reis' telephones.

Added to the book are four appendices of a purely technical character, but of the highest interest to the student. The first and third treat of the comparison between Reis' receivers and transmitters and those of more modern construction. The second takes up the question of variation of electric resistance at a point of imperfect contact in a circuit. Finally, the fourth treats of the doctrine of undulatory currents as applied to the transmission of speech by electricity.

Supplementary to this and ending the book, is a schedule of authorities referred to in the body of the work.

Whatever may be said regarding the merits of Prof. Thompson's arguments, it cannot be denied that they are presented in a clear and interesting manner, and in that terse style for which he is so well known.

The volume is well printed and fully illustrated by cuts, among which is a reproduction of a photograph of Reis holding his telephone. It cannot fail to interest those immediately concerned in the issues of which it treats, whereas, containing as it does, the early history of the telephone, its social interest and importance would make it a valuable addition to any library.

ELECTRICITY AS A MOTIVE POWER. By Count Th. Du Moncel and Frank Geraldy. Translated and edited, with additions, by C. J. Wharton. E. & F. N. Spon, London and New York, 1883. 12mo, 316 pp., 113 engravings and diagrams. Cloth, $3.

At the present time, the transmission of power by electricity is absorbing the attention not only of workers in that special field, but also that of the public in general. A book detailing in plain language what has been done in that direction, and what still remains to be done, must prove a welcome addition to the limited literature on the subject. The matter has been ably presented in the lectures of several scientists and scattered in the columns of numerous periodicals, but there are few books which present that subject specifically and in a systematic manner. The work under consideration may be characterized as a popular treatise containing just enough of elementary theory and formula to exemplify and fix the deductions arrived at by a course of easy reasoning. However, while broadly speaking this holds true, there are, nevertheless, parts which require a somewhat stronger mental application; such, for instance, as the introduction and the chapter on efficiencies. The former, after a few general remarks on electricity as a motive power, gives a brief explanation of the principles on which the construction of electro-motors is founded. In connection with this it details at some length the construction and laws of electro-magnets, and concludes by stating the means employed to diminish the detrimental effects produced in electro-motors.

The treatise proper is divided into two parts, entitled the first and second phases of electro-motors, which is equivalent to a division of the subject into the old and the new phase. The latter comprises all machines whose working depends on the principle of reversibility, which is of but comparatively recent application, while the former includes all the other machines. From this it follows that the first part is more distinctively historical in its nature, while the second brings us up to the doings of our own day. And such, indeed, is the case, as the first part is introduced by a chapter giving a historical summary of early experiments with electro-motors, in which we find the inventions of several Americans mentioned. Following this is a description of the primitive electro-motors of Jacobi, Froment, Pacinotti and others, and the special application of machines working on their systems.

Part II., the modern phase of electro-motors, is of a highly interesting character. It embodies the principal facts, and details everything of interest connected with the subject, since the application of the reversible principle to motors; and what makes it of still greater value, is that it brings the account down to within a few months of the present hour. This, considering the enormous progress recently made, gives it a peculiar value. The nine chapters of this part include the principles of the action of modern electro-motors and their application, and devote particular attention to the subject of the transmission and distribution of power, with a special chapter on the experiments made at the Paris Exhibition of 1881, and later at Munich. We may remark, also, that a fair share of space is allotted to electric railways, all of the more important being described, including the one recently opened at Portrush, in Ireland. The concluding chapter treats of the distribution of electricity as a motive power, and contains a discussion of the advantages of high tension for transmission, including a lucid explanation of the electric and mechanical efficiencies of motors.

Appended to the book is a series of short notes, among which is one on the efficiency and on the characteristic curves of dynamos.

The book makes a very interesting volume, and taken as a whole is well translated. In connection with the latter, however, we would remark that the expression, "Transport of Force," which occurs very frequently, although a literal translation, conveys a somewhat different idea in English from what it does in French; however, while it is by no means misleading, it might nevertheless have been rendered by the current phrase, "Transmission of Power." The work is copiously illustrated, and presents the subject in a manner which cannot fail to make it interesting and valuable reading.

Lieutenant Fiske's Work on Electricity.

To the Editor of The Electrical World:

SIR: The recently published book on electricity by Lieutenant Fiske, which you review in your issue of the 10th inst., is, in general, so admirable, that I venture to call attention to a few inaccuracies and omissions which, it seems to me, should be corrected in future editions.

If my experience be not uncommon, one of the most difficult tasks a teacher of science encounters is to cause the mind of the average student to grasp the fact that "work" is not necessarily performed in an up-and-down direction. Nearly all text-books, in treating the subject of work and energy, begin with illustrations drawn from gravitation effects, the consequence being that, when it becomes necessary to study the measurement of energy due to any other force, the student has to exert a considerable effort to get hold of the correct conception. How unfortunate is it, then, that the author should have given definitions of the "dyne" and the "erg," which are so misleading, as well as unscientific. A dyne is no more a *weight* than it is a repulsion or a friction. If the author's definition be correct, annihilate gravitation and we have no dyne. As to the erg, the inference from the author's definition is that unless we do work against gravity we have no means of determining the magnitude of that unit.

In treating the subject of potential, the author falls into the not uncommon error of confounding the "potential" of a body with its "potential energy." He writes (p. 37): "It therefore becomes necessary to adopt some expression which will show not only how much force a magnet pole or an electrified body can exert, but also how much work it can do. The expression used to convey this idea in electrical science is 'potential.'" Now the knowledge of the potential alone of a charged body will give no idea of how much work it can do; we must know also the magnitude of the charge. When we know both these quantities, we are prepared to calculate the potential energy of the body, and not before. Again (p. 39) he states: "If we raise a pound a distance of one foot, thereby doing a foot-pound of work, we store up an energy, or potential, of one foot-pound." Does he mean that if we raise ten pounds a distance of one foot, the (gravitation) potential of the ten pounds is ten times as great as that of the single pound? Clearly it is not so. One body may be charged with ten units of electricity and another with one unit and still both be at the same potential.

Potential is a *quality* or *condition* of a body or of *a point*, in virtue of which work must be done upon (or by) another body in bringing it to the first body, or to the point. It is not energy, although it is measured by the work which must be done to bring the *unit* (mass, or pole, or quantity of electricity) up from a place where the potential is zero. If we raise a mass m a height h against gravity, the potential energy of the raised mass is mgh. Its potential is its *condition* of being in a position of advantage with respect to gravity, and this is measured by gh; gh is numerically equal to the energy that would be expended in lifting the *unit mass* to the height h, and measures not only the potential of the body, but also that *of the level* to which the body is raised.

In treating of electromotive force, it is stated (p. 51) that "a difference of potential between two points exerts a certain force upon a quantity of electricity, which force tends to move it. To this force is given the name electromotive force." In several other instances throughout the book the author writes of electromotive force "overcoming" resistance; as "a force tending to move electricity against the resistance of a conductor," etc. Having already called potential potential energy, he now designates it a force, which it is not any more than it is energy. It is true that there is a certain analogy between a difference of potential and certain forces (pressures or tensions), but it is not less true that electromotive force is not force at all. And when it is stated that it requires a greater electromotive force to overcome a greater resistance than a small one, the statement is mischievous, for the inference at once is that there will be no current through a conductor of very great resistance when the difference of potential between its extremities is very small.

With reference to the polarization in a voltaic cell, it is stated (p. 44) "as hydrogen and copper form almost as strong a galvanic couple as zinc and copper, they set up a current of their own opposed to that of the zinc and copper." This is most misleading. Certainly no opposing current is set up; and even if it were true that the copper and hydrogen *tend* to set up a current of their own, this current would be in the same direction as that of the cell. The true statement of the case would be that the contact difference of potential between the hydrogen or the battery liquid is opposed to, and nearly equal in magnitude to, that between the zinc and the liquid; hence the total electromotive force of the cell (the algebraic sum of the contact differences of potential, or of the chemical affinities) is diminished.

The description of the current (p. 51), though not posi-

tively erroneous, is bad, because it conveys the erroneous impression that the current strength may be increased, in all cases, by constructing up more cells in series. I venture to say that not one person in ten, having no previous knowledge of the subject, will perform the experiment as laid down, and arrive at the result described. Especially would this be the case if Daniell's cells were used.

In the definition of the practical unit it seems to me an error to call the "coulomb" the "unit *quantity* of current." Taken in connection with the preceding definition of the ampère as the "unit *strength* of current," it implies two qualities in a current—strength and quantity. The effort of most modern writers on electrical subjects has been to abolish the use of the terms "intensity" and "quantity" applied to currents, as unnecessary and misleading, but here we have the idea conveyed that "strength of current" and "quantity of current" are two different things. The coulomb is a quantity of electricity, and it makes no difference whether the electricity be flowing or at rest. A condenser of a farad capacity, charged to a potential of one volt, will contain a coulomb.

So much for sins of commission. Those of omission are not so serious, though they should be corrected also.

The author gives two methods of measuring the resistance of a battery, both of which might well have been omitted. Mance's method is tedious and unreliable. The other method assumes the equality of the resistances of two cells, which is rarely the case. It is to be regretted that the excellent method of Lieut. Couden, with which the author is familiar, should have found no place in the book. Couden's method is expeditious and accurate.

Of the two methods of measuring the electromotive force of a battery, the method by the quadrant electrometer is difficult and the other unreliable because of varying currents, hence variable electromotive force, and the necessity of obtaining like deflections of the galvanometer. No mention is made of Law's method with the condenser, a method which is accurate and by which comparisons can be quickly made. The more simple method of connecting up the battery with a large resistance and a galvanometer of known constant, and calculating the electromotive force by Ohm's law is greatly preferable to that described in the book.

In treating of the telephone, no reference is made to the telephone of Dolbear, the most simple of these instruments, and the most original since that of Reis. A description of the induction balance would add to the value of the book, inasmuch as the principle involved in that instrument has been applied, with some success, in controlling accidental induction in telephone lines.

Edison's steam dynamo has been described time and again, but no description of his smaller dynamos, with which electrical engineers are more likely to be brought in contact, has as yet found its place in any text-book.

Lieutenant Fiske's book is, undoubtedly, the most valuable work on electrical science that has appeared in this country, and it takes an honorable position among the best electrical works extant. I sincerely hope it will speedily reach a second edition, in which the faults of the present one may be corrected. THEO. F. JEWELL.

TORPEDO STATION, NEWPORT, R. I., Nov. 18, 1883.

Another Trial of the Daft Motor.

In our issue of Sept. 22 we gave a description of the Daft motor, employed for running cars by electricity. We now take from the New York *Times* an interesting account of a further eventful test made at Saratoga on Nov. 24. We may add that Mr. Kellogg, the president of the road on which the experiment was conducted, is understood to have spoken of it as a success and to have given an order for four five-ton motors, to be placed on the road next year, each motor to haul three cars:

During the past two years, says the letter from Saratoga of the 24th, Mr. Leo Daft, an electrician of repute, has been experimenting with a motor at his laboratory in Greenville, near Jersey City. His purpose has been to perfect a machine, which, propelled by electricity, should be capable of operating on railways and take the place of the steam locomotive.

This afternoon Mr. Daft gave the first practical exhibition of the motor on the Saratoga, Mount McGregor & Lake George Railroad, a line about 12 miles long, with sharp curves and steep grades. The Daft Electric Light Company, of New York, which controls the motor, brought a party to Saratoga to-day to witness the motor's workings. There were between sixty and seventy gentlemen from New York, Brooklyn, Newark, Boston and other cities. Mr. Daft had prepared a stretch of track a mile and an eighth in length and covering a steep grade and a sharp curve upon which to run his motor, which, weighing two tons, had more the appearance of a tender to a pony locomotive engine than anything else, and was about 8 feet long, 4 feet wide, and 5 feet high. Its working machinery—the armature, the receiving dynamo, the contact wheel, and connecting wheels—was concealed from inquisitive eyes. The Mount McGregor Railroad is narrow gauge. The passenger cars weigh about five tons each. It was to one of these coaches that the motor was tied—there being no coupling-pin at hand—with a piece of 3 in. rope. Along the centre of the track a third rail was laid, and from this rail the electric power was taken up by the motor. The electric current in this instance was generated by dynamos at a factory one-eighth of a mile from the railway station and 500 feet from the track, to which it was led through wires. The generating engine was 25 horse-power. The current is fed to the central track, and is taken therefrom by a contact wheel, which in turn transmits it to a receiving dynamo and causes the revolution. This is carried to the axles by two pulleys differing in size and connected by a steel belt. A switch placed on the upper section or platform of the motor, in front of the driver or engineer, regulates the speed and governs the forward or backward motion. Another switch controls the brake, a double magnet, by means of which the motor may be stopped, the inventor claims, with more than the suddenness of the air-brake.

It was nearly four o'clock when the motor was attached to the car that had been waiting for it at the railway station. The passenger car was filled, there being about fifty gentlemen sitting and standing and crowding the platform. On the motor eight or ten others were sitting. When the word was given, Mr. Daft slowly applied his power to the motor, and with the utmost ease the train was started. Mr. Daft had accomplished his purpose—he had drawn a passenger coach, crowded, out of the station of the Mount McGregor Road. And it was the first coach load of passengers that ever started on such a journey. It was a practical exhibition of an electric motor. Here was a 2-ton motor drawing a 5-ton car loaded with five tons of passengers, propelled by an electric current generated by a 25 horse-power engine consuming about two pounds of coal per horse-power per hour. The grade just after leaving the station, perhaps a half mile, begins at the rate of about seventy feet to the mile, and up this the little motor climbed, slowly, but without a halt. It was a little unsatisfactory, perhaps, that Mr. Daft did not stop his motor on the grade, and demonstrate what he says is accomplished with ease—regaining motion on a grade, either going backward or forward, after a halt. But this he did not do. The motor climbed seriously up to the end of the circuit, the time being eleven minutes in covering the mile and an eighth from the starting point—or, say, five miles an hour.

The return trip was the feature of the occasion. As has been remarked, the grade was 70 feet to the mile, and the motor and car—the latter taking the lead—began to traverse the distance with accelerating speed. The passengers were intently watching the motor, when, as the curve was reached—a curve with a radius of 1 in 20 feet—there was a sudden snapping of the bell-cord that passed from the motor to the car. An instant later the motor, running 10 miles an hour, had jumped the track, and the gentlemen riding thereon were hurled through the air by the sudden stoppage and many of them half buried in the soft sand on either side the road-bed. Mr. E. N. Dickerson, Jr., and Mr. J. M. Mitchell, both young attorneys, of New York, fell directly in front of the motor as it and the car parted company, but, fortunately, the motor's progress was suddenly checked by the wheels plowing into the sand, else these gentlemen must have been seriously injured, if not instantly killed. The car had meantime been stopped by applying the brakes. The motor was a complete wreck—its electrical gearing being scattered in every direction or bent into unrecognizable shapes beneath the framework. It showed that electric motors and steam locomotives somewhat resemble each other after an accident, at least, if not before. The forward end of the motor was thrown about two feet beyond the outer rail of the curve, while the hind wheels were resting on the ties close to the inner rail. A brass bell weighing about 30 pounds was broken from its hangings and fell near Mr. Dickerson's head, while another gentleman found himself covered with fragments of the pulleys—thin iron wheels which carried the power from the dynamo to the axle. Others were covered with sand or choice Saratoga mud, while silk hats became part and parcel of the general ruin that had been so lavishly dispensed by the hand of Chance. There had been a great and sudden collapse of everything, from enthusiasm to electric energy. The life was gone from everything. There was at first a general feeling that a darker shadow than the destruction of the inventor's machine has fallen upon the event. But when the unfortunate ones began scrambling to their feet, brushing the dirt from their clothes, wiping their faces, pushing the dents out of their hats, working their knee-joints and straightening their umbrellas, there was a great feeling of relief that things were no worse in a physical point.

Mr. Daft, from his gentle manipulation of the little switch on the motor and his happy, satisfied seat of success, where he sat serene a moment before, was lifted out of a very soft spot between the two tracks, looking very pale and more serious than ever. As his friends gathered about him he pulled himself together slowly, looked ruefully at the ruin at his feet, stepped upon the fragments of a wheel, and said:

"We were going too fast." Those who stood near didn't ask him to make affidavit to this statement. The evidence was before them.

The party of New Yorkers and their friends from neighboring cities—lawyers, railroad men, electricians, bankers, capitalists and others—started for the station afoot. Some of them were limping and a good many of them cursing the luck that brought them to this winter-dead resort. As they sadly picked their way down the track, a good three-quarters of a mile to the station, the car they had left was suddenly whirled past them, drawn by locomotive George West, No. 2, which had been sent up from the station to look after the wreck. Thus old-fashioned steam went to the aid of electricity, and towed back to port what was left of the expedition that sailed away so joyously only a few moments before.

Mr. Daft's misfortune was certainly appreciated by all who formed the party, and they assured him as best they could that he had demonstrated a principle beyond question—the accident could not be attributed to anything but a failure to use necessary precautions in rounding a curve.

Just before the train with the New York party left the the Saratoga station the *Times's* representative called to the engineer of the locomotive that was to draw the special cars to Albany: "How fast can you run round a curve?" "Pretty fast, you bet." "But how fast can you go round the sharpest curve you ever saw?" "And not jump?" "Yes, yes." "Well, about 45 miles an hour with this engine. She can drive 60 miles on the straight."

THE TELEGRAPH.

THE POSTAL COMPANY IN ST. LOUIS.—A dispatch from St. Louis says: The Postal Telegraph Company, which has been quietly raising poles and making other preparations for an invasion of this city, applied to the Merchants' Exchange, on the 19th inst., for leave to open an office on the floor. The application was laid over until the December meeting.

IN FAVOR OF WESTERN UNION.—In the Court of Appeals at Albany, N. Y., on Nov. 27, the motion recently made by the plaintiffs for a reargument of the appeal in the case of Williams against the Western Union Telegraph Company was denied, with costs. This leaves the former decision intact, and finally settles the litigation in favor of the Western Union.

THE A. D. T. CO., OF BROOKLYN.—At the annual meeting of the stockholders of the American District Telegraph Company, of Brooklyn, on the 19th ult., the following gentlemen were elected trustees for the ensuing year: H. W. Slocum, H. D. Polhemus, W. C. Kingsley, M. N. Packard, Felix Campbell, H. W. Hunt, Charles Rushmore, Tunis J. Powell, John Williams, A. C. Keeney, J. F. Pierce, S. W. Battershall, J. S. Hulin, S. H. Herriman, N. W. T. Hatch, W. M. Van Anden, H. H. Wheeler and A. B. Thorn.

THE CIVILIZING WIRE IN RUSSIA.—The telegraph line in the northern part of the Czar's empire has produced a sensation among the birds and beasts of the snowy regions. It has been discovered that all the telegraph poles have been pierced through and through by a species of woodpecker. The bears have also proved to be enemies of the telegraph. Michael Ivanovitch, as the Russians call the bear, takes the noise of the wind playing upon the wires for the buzzing of bees, and so he pulls down the poles to find the honey. But wolves shun the civilizing wire. However hungry they may be, they never approach villages situated on the line of the telegraph. And now provinces which have been losing thousands of cattle as the prey of wolves are raising money to build telegraph lines as the best sort of scare-wolf known. It may safely be predicted that in a few years the Czar's country will be covered with a network of wolf-scaring wires. Talk of Russia being slow in adapting modern means of civilization!

SYNCHRONOUS MULTIPLEX TELEGRAPHY.—Before the Franklin Institute, Philadelphia, by request of Secretary Wahl, Professor J. B. Houston, the eminent electrician, gave an interesting explanation on the evening of the 21st ult. of the synchronous multiplex telegraph system, which he pronounced "the most wonderful invention in this age of electricity, since it is a means whereby seventy-two distinct and separate telegraph messages can be simultaneously transmitted on the same wire." He explained that the system was based upon the synchronous rotation of two cylinders, one at each end of the line, whereby a single wire is connected at both ends simultaneously to corresponding operating instruments, and transferred from one set of instruments to another so rapidly that the operators transmitting or receiving do not realize that the line has been disconnected from one instrument and given to another, since each operator always has the line at his disposal, even at the highest rate of manipulation.

THE POSTAL TELEGRAPH AND CABLE CO.—As we stated last week, the Postal Telegraph Company has just completed a sale of all its property, franchises, patents, etc., to the Postal Telegraph and Cable Company, of which H. C. Gardiner is president. The Postal Company has already completed a working line of telegraph under its system, and the new company that has succeeded to its property and franchises expects to have the line extended and in operation by February 1, next, to St. Louis, Pittsburgh, Buffalo, and Washington. In two years from this date the president of the company, Judge Gardiner, says its officers expect to have completed and in operation telegraph lines to all the principal cities in the United States, including San Francisco, Portland, Or., and New Orleans, besides a new Atlantic cable to Europe and a cable to Brazil.

It is contemplated that the company will use the new Atlantic cable now being constructed by James Gordon Bennett and Mr. Mackey, the California millionnaire. If a combination cannot be made with them, the Postal Telegraph and Cable Company will construct an Atlantic cable of its own. The tariff of charges by the new company will be 25 cents for 20 words to all points in the United States, without regard to distance.

THE ADOPTION OF STANDARD TIME.—On Sunday, the 19th ult., the new standard of uniform time was quietly adopted throughout the country. The change involved a good deal of work to Mr. James Hamblett, the gentleman in charge of the time telegraph instruments at the Western Union building, but the operations were of a nature involving extreme accuracy and delicate manipulation, not great activity or hurried movement; therefore the Sunday stillness of the lofty building remained, to all intents and purposes, unbroken. When the time ball fell, Mr. Bogart, the wire chief, the chief operators of the Western Union Company and Mr. W. F. Allen were the only persons present besides Mr. Hamblett. There was nothing unusual in the fall of the ball, which is effected from Washington, except its tardiness. Mr. Hamblett stood by his instruments to note the error of the fall. He found that his morning's work had resulted in the adjustment of the main electric clock and of the standard clock in the Western Union operating room to within one-tenth of a second of absolute accuracy. Mr. Hamblett began his morning's work at nine o'clock. Precisely at that hour he stopped the main electric clock, which furnishes the time to all the principal jewellers in the city. By means of a chronometer he measured the interval of change as nearly as possible, starting the clock approximately at 9h. 3m. 58 38-100s. with the aid of a chronometer. Then he went upstairs to where the chronographs are situated and compared the beats of his clock with those of the Cambridge Observatory timepiece, the two sets of beats being electrically recorded side by side by a series of indentations on a paper ribbon. The two sets of dots were compared with the aid of a microscopic scale, and through a little manipulation brought into exact accord.

THE TELEPHONE.

LEXINGTON, Mo., is to have a telephonic system connecting it with other towns.

AYER, MASS.—The Ayer Telephone Exchange embraces the towns of Pepperell, Groton, Shirley, Harvard, Littleton and Ayer; 40 instruments are located, at a cost of $36 per year each. The office is kept open night and day, and is in charge of Mrs. Nellie Kittredge and two assistants, who report business as increasing rapidly.

DAMAGE CAUSED BY A CROSS.—At Harrisburg, Pa., recently, the transmitters in the House and Senate telephones were burned out by the telephone wire coming in contact with an electric light wire. Superintendent Ker, of the telephone line, says the telephone company will bring suit against the electric light company to recover damages.

A NEW WEST VIRGINIA COMPANY.—A certificate of incorporation has been obtained from the Secretary of State of West Virginia for the Valley Telephone Company, a corporation for the purpose of constructing and maintaining a system of telephone lines between Harper's Ferry, Charlestown, Shepherdstown, Middleway, Martinsburg, Ripon, in the State of West Virginia, and Berryville, Winchester and Staunton, in the State of Virginia, and intermediate points, connecting with a telephone line along the Chesapeake & Ohio Canal. The main office of the company is to be at Charlestown, West Va., and the capital is limited to $10,000.

A RUINED VOICE.—At last a specific case is given of loss of voice on the part of a telephone operator, but one would like to know a little more of the circumstances. The report comes from Hartford that the frequent exclamation of "Hello" through the instrument has worn out the voice of Miss Bessie Joslyn, who has suddenly been taken with an affection of the throat, and cannot now speak louder than in a whisper. It is also said that her voice was similarly affected on three occasions before, but was restored to full vigor on each occasion in a few days. One natural inference from the recital of the alleged facts is that the young lady had a weak voice to begin with.

A TELEPHONE ON FIRE.—A Cleveland paper of the 22d ult. says: While sitting in his office in the Rouse Block about 10 o'clock yesterday morning, Mr. D. R. Taylor's attention was attracted by a peculiar crackling sound in the vicinity of the telephone. Smoke was issuing from it, and in a moment flames burst out, but the presence of Mr. Taylor and his prompt application of a little water averted what in his absence might have proven a considerable blaze. It being but a few minutes before the thunder storm, it was thought that might have occasioned the disturbance, and, if not that, probably the telephone wire came in contact with the electric light wire, and the current of electricity was thus turned in upon the telephone.

A SERMON HEARD 100 MILES OFF.—The Columbus, Ga., and Montgomery, Ga., papers report that the opening hymn, prayer and a portion of the sermon in the Sunday morning service at the Presbyterian church, Columbus, Ga., were heard distinctly by telephone at Montgomery, Ga., over the telegraph wires recently. The cities are one hundred miles apart. Mr. T. L. Ingram, the manager at Columbus, connected also with Macon on the same day, and equally good results were obtained in conversation between these two points, which are also about one hundred miles distant from each other. It is now proposed to connect Augusta, Columbus and Macon in one circuit, by way of experiment.

THE ELECTRIC LIGHT.

IN A WATCH FACTORY.—The N. E. Weston Company are about to install a 100-light Maxim plant at the American Watch Co.'s factory, Waltham, Mass.

A HARRISBURG YARN.—The danger of electricity was shown last Monday evening at the Lochiel hotel by the jumping of fire from the electric light wire to a metal gutter pipe four feet away.—*Harrisburg (Pa.) Telegram.*

B. & O. ENTERPRISE.—The new circular passenger car shop now approaching completion at the Mount Clare works of the Baltimore & Ohio Railroad, in Baltimore, the largest building of its kind under roof in this country, is to be lighted by electricity.

TRUSTEES OF THE EDISON CO.—The following named were elected trustees of the Edison Company for Isolated Lighting on the 22nd: Thomas A. Edison, S. B. Eaton, E. H. Johnson, Charles H. Coster, Spencer Trask, J. C. Henderson and Anthony J. Thomas.

LIGHTING THE PULLMAN SHOPS.—The Pullman Palace Car Works are to be completely fitted up with Brush electric lights and Swan incandescent lamps furnished by the M. C. Bullock Manufacturing Company. These lights will be driven by a straight-line engine.

MEXICO.—The Brush electric light continues to find favor in the republic of Mexico. Oaxaca now has it, and the lamps at Merida, Yucatan, were recently lighted amidst great rejoicing. Guanajuato has added twenty lamps to the installation on the principal plaza.

A LIBERAL OFFER.—The Brush-Swan Electric Light Company, of Washington, proposes to place 6,000-candle power lights on the Capitol building, Washington monument, treasury building, and in several of the public parks for one month at the expense of the company.

THE COLUMBIAN MILLS, SOUTHBRIDGE, MASS.—A Corliss engine has been put in position at the Columbian Mills, Southbridge, Mass., and as soon as it is in running order the works will be run day and night, making use of the electric light, and will turn out 70,000 pounds of yarn per day and 65,000 by night.

DISAGREEABLE AFTER-IMAGES.—A special correspondent of the *Nature* states that most of the incandescent lamps at the Vienna International Electric Exhibition had transparent bulbs, and complains that very disagreeable after-images of the glowing carbon filaments were caused if they were looked at only for a moment or two.

ARC AND INCANDESCENT LIGHTS ON THE SAME CIRCUIT.—The N. E. Weston Company are introducing, as fast as they can be made, their new regulator, which permits arc and incandescent lights to be burned on the same circuit. Lights burning in this way may be seen at the offices of the New England Trust Co., Lee, Higginson & Co., Lockwood & Brooks, and others, at Boston, Mass.

SIXTEEN-CANDLE LAMPS FOR SATANIC HORNS.—An amusing adaptation of the incandescent light has been made at the Bijou Theatre, Boston, in the last act of "Virginia." The two red horns on the devil contain 16-candle lamps, which, being connected with the Edison system in the theatre, are lighted when the devil disappears upward, producing a striking effect.

THE BRUSH CO.—The Brush Electric Light Co., is now ready to take orders for storage batteries to be delivered within three months' time. The Brush Company announces improvements in the armature of its dynamo which largely increases its capacity. Thus an improved No. 8 dynamo, which formerly gave 40 lights of 2,000 candle power, will now give, it is claimed, from 55 to 60 lights of 2,000 c. p., or from 75 to 80 lights of 1,200 c. p.

JUST WHAT WE WOULD LIKE, TOO.—The largest electric light in the United States is swinging from the tower of the *Record* building, Philadelphia. It is claimed to give the light of 10,000 candles, and from the photometric standpoint of the electricians, who claim sixteen candles for the Edison fire-fly, it no doubt does. Swung from its eighty or ninety feet elevation, it is very pretty; but we would like to see one half that candle power in gas-light put against it.—*Water Gas Journal.*

ADVANTAGES OF THE LIGHT IN THEATRES.—Prof. Max Pettenkoffer has recently given in a Vienna paper a detailed opinion of the electric light in theatres, in which he draws the following conclusions: 1. The electric light hinders, to a great extent, the overheating of the air in the theatre. 2. Of course, it does not render ventilation of the theatre superfluous, but affords in itself a more thorough means of ventilation than gas-lights, which contaminate the air of the room by the heat and products of combustion, both of which are avoided by using the electric light.

THE LIGHT IN PROVIDENCE, R. I.—A long and interesting hearing was given on Tuesday evening, the 20th ult., by a special committee of the Providence City Council on the petition of the American Electric and Illuminating Company of Boston for permission to run its lines through the streets. The Rhode Island Electric Light Company appeared by counsel as a remonstrant, and Congressman Spooner represented the petitioners. Testimony as to the responsibility of the petitioning company was presented, and the general question of systems, companies and various other matters were gone into quite largely, after which the hearing adjourned, subject to the call of the chairman.

THREE MILES OF ILLUMINATED SEA-SHORE.—The Town Council of Brighton, England, has decided to apply to the Local Government Board for sanction to borrow for electric lighting purposes. A site for a central station has been selected to serve the area which the corporation are first bound by their provisional order to supply, and the earliest consideration will be to light the sea front, which it is thought when illuminated throughout its length of three miles will present a brilliant if not unique spectacle. The eastern part of the parade, on a sea wall one mile long and sixty feet high, would look particularly fine from the sea. It was also decided to complete the electrical lighting of the Royal Pavilion.

A CONVENIENT NIGHT LIGHT.—Visitors to the Foreign Exhibition this week, says the Boston *Manufacturers' Gazette* of Nov. 24, have noticed a feature of the Edison system that has been added within a few days to the decidedly artistic "setting" of the company's office quarters in the gallery of Franklin Hall, in front of the Restaurant Vendome. This is a two-light attachment for night lights, which will fit any socket, the one in point being connected to one of the lamp sockets in the flower basket by means of a common silk-covered, flexible cord. The lamps are of the sixteen-candle style, and one or both may be used at the full candle power; or else the two lamps may, by means of a centre switch, be put in series, thus bringing them down to a red glow, giving ample light for a night lamp. These attachments are made in polished brass and gold bronze, the base of the standard to which this one is fitted being of black marble, from which rises a brass shaft with a decorated china well. The two-light attachment can be replaced with one light, thereby making a student lamp. The whole device can be carried round anywhere to the length of the cable of cord, this one being five or six feet in length, and is a most interesting sight.

MISCELLANEOUS NOTES.

THE MACKEY-BENNETT CABLE.—Mr. James Gordon Bennett is expected to return to this country in a few weeks, for the purpose of attending to business connected with the *Herald* and the new cable company.

THE LATE SIR WILLIAM SIEMENS.—Of the late Sir William Siemens the *Pall Mall Gazette* says: "It is strange that a street stumble should cut short the vital energies of one who wielded Jove's thunderbolt and added a fresh glow to the fires of Vulcan."

STREET RAILWAYS.—The Cincinnati *Commercial Gazette* suggests that it would be well for the projectors of street railways on the cable system to await further developments of the application of electricity to this service in Paris, before making any extensive investments.

AN ELECTRIC CANOE.—An electrician is said to be engaged in inventing an electric canoe engine, to weigh only 100 pounds and warranted to drive a 14-foot canoe at the rate of fifteen knots an hour at the cost of only 10 cents per hour for fuel. What do "Rob Roy" and his disciples say to this?

ALUMINUM.—The English correspondent of the *American Manufacturer* writes that this metal is now being extensively applied in the manufacture of field telegraphs and telegraph connections, large orders having been received from the British Government. The application of the metal to jewelry, mathematical and musical instruments and the like is very greatly increasing.

A PRIZE ELECTRIC SIGNAL CLOCK.—The electric signal clock, manufactured by Blodgett Bros., of Boston, has been examined by the committee of science and arts of the Franklin Institute, who recommended that the Scott legacy medal and premium be awarded it. This clock is designed to give any kind of fixed signals at any regular or irregular intervals, and especially to cause the striking of warning or departure signals for railway trains or street cars, according to the time table in use.

ELECTRIC GAS LIGHTING.—In our "Electric Light" department we have called attention to a bitter controversy going on between two electric lighting companies.

There may not be much connection between electric lighting and electric gas lighting, but we cannot help being struck by the coincidence that at the present time, as reference to our advertising columns will show, a controversy is also being carried on with asperity between the Electric Gas Lighting Co. and the Electrical Supply Co.

CHARGING FOR ELECTRICITY BY WEIGHT.—The Electrical Power and Storage Company of London recently sent a secondary battery, charged and ready for use, into the country. The railroad company charged twenty-two shillings and six pence for the outward journey, and only seventeen shillings and sixpence for the return, and in re-

ply to a remonstrance at this difference of rates explained that the cells went fully charged, but returned empty. The joke is on the railroad company, which has since learned that electricity is an imponderable agent.

THE SPEED OF TRANSMISSION BY CABLE.—According to recent trials of the speed of working on the Jay Gould cables laid across the Atlantic from Penzance to Canso, in Nova Scotia, 1,000 code words were sent from Penzance and received at the Canso station in 81 minutes, including all repetitions and corrections. The 1,000 words consisted of 7,288 letters, which is about equivalent to 1,458 words of 5 letters each, the average number for the English language. The above rate of transmission is therefore equal to 18 words of 5 letters per minute.

SECONDARY BATTERIES AND THE STORAGE OF ENERGY.—In a recent lecture on secondary batteries and the electrical storage of energy, Prof. Oliver Loge says that, instead of a plain lead plate, lead sponge may be employed for the negative plate, and this is made by blowing high pressure steam through a jet of molten lead, thus securing an enormous surface which enables the spongy lead to go on acting for a much longer time than the plain lead. A copper plate may be substituted for the lead negative plate, and will give a strong and lasting current. It lasts, of course, because copper sulphate is soluble, and no insulating scum is formed; but that this cell has a fairly high electromotive force is a striking proof of the value of peroxide of lead as the electro-negative element of a battery. Even platinum gives a current when opposed to peroxide of lead, though of course it is a feeble one. But if zinc is used, we have the strongest practicable battery the writer knew of, each cell having an electromotive force of 2.5 volts.

LOCATION OF THE MAGNETIC POLE.—In a lecture at Glasgow, Prof. Thompson stated that the magnetic pole is at present near Boothia Felix, more than a thousand miles to the west of the geographical pole. In 1657 the position of the needle showed the magnetic pole to be due north. It had been eastward before that; it then began to point westward, and this westward variation continued until 1816, when the maximum was attained; it has since steadily diminished, and in 1976 it will again point to the true north. Prof. Thompson says that the changes which have been observed, not only in the direction but in the strength of the earth's magnetism, show that the same causes which originally magnetized the earth are still at work; and, strangely enough, these changes do not occur at long intervals in the course of centuries, but are going on from day to day, from week to week, and from year to year.

THE FAURE ELECTRIC ACCUMULATOR CO.—An adjourned general meeting of the Faure Electric Accumulator Company (limited) was held in London on the 6th ult., and adjourned for one month on the representation of the chairman that the directors were in the midst of the issue of the shares of the French Metropolitan General Electric Company (limited) in Paris. Charges were made that the directors were trying to shirk submitting the accounts. These charges the chairman repelled. He said they were not yet in position to present the accounts, and the solicitor stated that unless the French Company succeeded, the Faure Company, as had been previously explained, would have no future; but it appeared to him that the French company were making every effort to place themselves in funds, in order to succeed on the continent in the great work they had undertaken. He had himself recently seen in Paris the successful manner in which the accumulators had been applied for traction power in the working of an omnibus. The London company holds three-fourths of the stock of the French company, and its experiments are designed to settle the question of the commercial value of the Faure storage battery system.

STOCK QUOTATIONS.—Telegraph, telephone and electric light stocks were quoted on Thursday of last week and Tuesday of this week as follows:

	Nov. 22.	Nov. 27.
TELEPHONE.		
American Bell Telephone	190	191
Union Telephone	....	....
Bay State Telephone	....	....
Tropical Telephone	2⅛	....
Mexican Telephone Co.	3¼	3
National Bell Telephone of Maine	....	....
New York and Pennsylvania	....	....
Boston & Northern Telephone	....	....
People's Telephone	7	....
Suburban	....	....
Erie Telephone	46	....
New York and New Jersey	85	....
Hudson River Telephone	105	....
Globe Telephone	30	....
New England	70	....
Continental	....	....
Dolbear	....	....
TELEGRAPH.		
American Cable	62⅛	62⅛
Western Union Telegraph	79⅝	79¼
Bankers and Merchants' Tel.	138½	139
Mutual Union Telegraph	17¾	17½
American District Telegraph	16	16
Postal Telegraph Bonds with stock	....	....
ELECTRIC LIGHT.		
Brush Electric Light	....	95
Edison Electric Illuminating	....	....
Edison Electric Light	150	....
Edison Isolated	....	....
U. S. Electric Lighting	117	117
United Globe Electric Light	85	...
Fuller Electrical	....	....
Swan Electric Light Co.	110	....
MISCELLANEOUS.		
Commercial Telegram	....	125
Electric Railway of U. S.	....	....

THE "ELECTRICAL WORLD'S"
ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

ALL THE ATENTS MENTIONED BELOW ARE DATED NOV. 20, 1883.

Apparatus for regulating electric currents; S. F. De Ferranti, of Richmond Gardens; Shepherd's Bush and A. Thompson, of Guilford Place, Russell Square, County of Middlesex, England.....288,315

A movable coil acted upon by two fixed coils controls a set of reversible gears, which receive their motion from some revolving part of the dynamo whose current is to be regulated. These gears are connected with the commutator brushes of the dynamo, or graduated resistance placed in the field current or with the governor of the engine driving the dynamo. Fig. 1 is a vertical section of the regulator, and Fig. 2 is a sectional plan view. The inventors in their patent describe two ways of effecting the shifting of the gears, one operating by the direct action of the movable coil on the shifting mechanism; the other acting through the medium of an electro magnet. We have selected the latter for our illustration. The current is taken through the swinging coil *I* and fixed coils *J*. When no current or too feeble a current passes through the circuit the swinging coil is drawn by the spring *G*, so as to bring the arm *H'* into contact with the pin *N*. As the current increases the coil *I* tends to move in opposition to the spring *G*, and when the latter is overpowered the arm *H'* leaves the pin *N*, breaking the electric contact. If the current continues to increase in strength the arm *H'* is brought into contact with the pin *O*. The contact pins *N O* are connected with the terminals of the magnets *M M*, and the contact of the arm *H'* with one or the other of the pins *N O* determines which magnet shall be active in operating the clutch mechanism with which it is connected. Two bevel wheels *A B*, loose on the spindle *C*, are turned in opposite directions by the wheel *D* and a sliding clutch *E* on the spindle is controlled by the lever *F* moved by the magnet *M*. This clutch is capable of engaging either of the beveled wheels *A B*, according to the direction in which the spindle *C* is to be rotated to produce the desired effect on the commutator brushes or other regulating device with which it may be connected.

Fig. 1

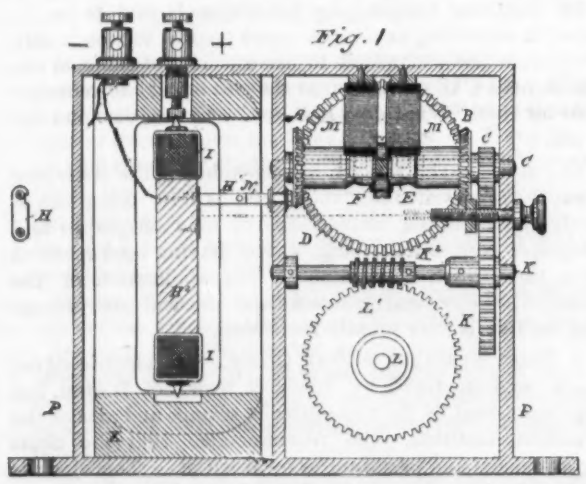
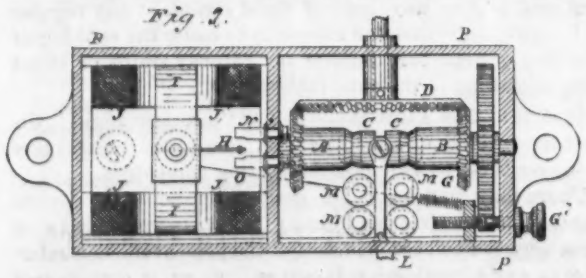


Fig. 2.



Compound electrical conductor; L. Johnson, of Vincennes, Ind.....288,443

This conductor is formed of a thick wire of low conductivity, and a thin wire of high conductivity, the thin wire being imbedded in the thick wire and forming a part of the circumference thereof.

Current regulator for electric light circuits; C. R. Arnold, Philadelphia, Pa.....288,393

An axial magnet in the return conductor of the electric circuit acts in conjunction with the usual engine governor in controlling the speed of the engine employed in driving the dynamo.

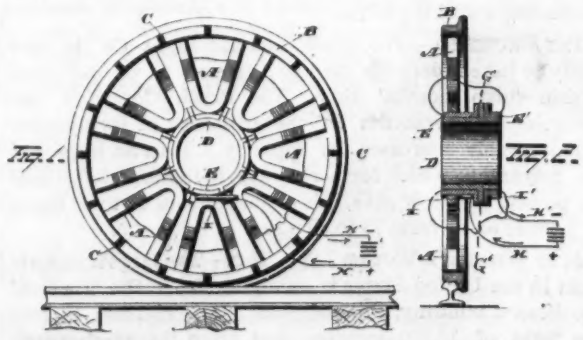
Contact for electric lamps; H. Edmunds, Jr., of New York city, assignor to Thomas J. Montgomery, of Boston, Mass..... 288,217

The circuit is closed or broken by a partial rotation of the base of the lamp.

Electric lamp; E. K. Knowles, of Brooklyn, N.Y, assignor of one half to Byron A. Brooks, of same place.....288,346

This lamp has two regulating electro-magnets, one being of high resistance, the other being divided into sections of low resistance. The lamp is provided with a novel and effective clutching device.

Device for magnetizing the tires of drive-wheels of locomotives; E. J. Molera, of San Francisco, Cal., assignor to John C. Cebrian, of the same place..... 288,356



The drive-wheels are composed of electro-magnets *A*, which form the spokes, and of tires formed of segmental section *B*, insulated from each other by iron-magnetic blocks *C*, the legs of the magnets being attached to the tire sections. The magnets are grouped around a hollow central cylinder *D*, in which are mounted the commutator plates *E E'*. When a current is sent through the conductors of the electro-magnets, the wheels are made to adhere to the track rails, increasing the traction and permitting of using the wheels as effective brakes.

Electric hotel-annunciator and fire-alarm; Albert T. Hess, Des Moines, Iowa.....288,570

This improvement consists mainly in combining relays and independent circuits and batteries with bells at remote distances from the main battery for the purpose of augmenting the power required to ring distant bells.

Polarized electric bell; W. J. Bowen, of Norwalk, Ohio, assignor to himself, T. T. Keckeler, of Cincinnati, O., and T. C. Shiving, of Marshall, Mich..... 288,202

A horseshoe magnet has an electro-magnet attached to each of its poles, these magnets extending inward toward each other. An armature between the poles has its lower end pivoted centrally within the horseshoe magnet, and its upper end carries the belt hammer.

Railway signal apparatus; Fred Lane, Boston, Mass.....288,348

This is a railway crossing signal which is provided with a mechanical motor for limiting the time during which the signal is given.

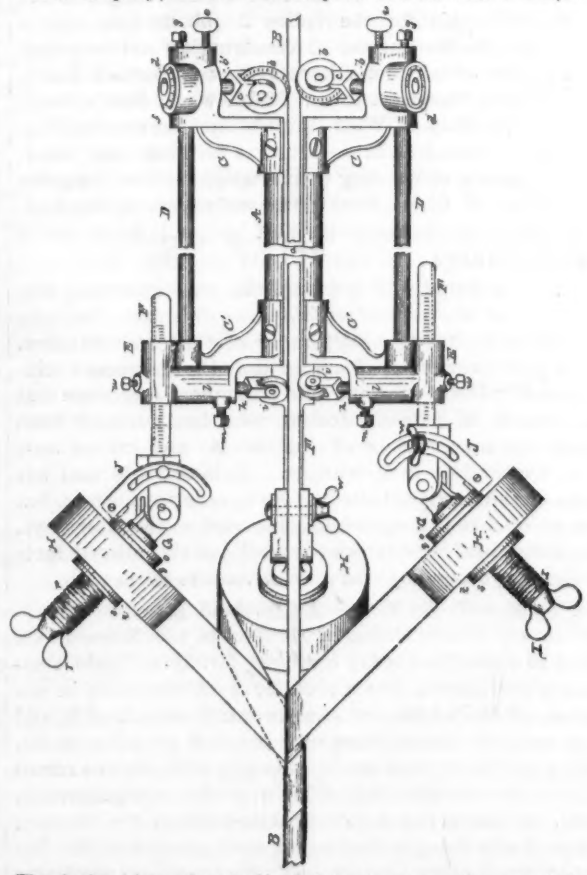
Regulator for dynamo-electric machines; T. A. Edison, N. Y., assignor to the Edison Electric Light Co., of New York city..... 288,318

There is combined with the electric generator an adjustable resistance in addition and external to the field-magnet coils, and located directly in the field circuit of the generator, for primarily and directly regulating and varying the strength of the field-magnet below the point of saturation.

System of laying subterranean lines of electric wire; Henry B. Cobb, of Wilmington, Del..... 288,310

The principal feature of this invention is a tube of insulating material, having a close and permanent covering of metal, for inclosing the electric wire.

Machine for insulating electrical conductors; John Kruese, of Brooklyn, N. Y., assignor to the Electric Tube Company, of New York city 288,454



The body *A* has a longitudinal slot *a* to receive the wire to be covered. There are three oblique guide rollers *b*, which centres the body upon the wire, and the body carries three oblique coils *H*, of insulating tape, which is wound upon the conductor as the apparatus is revolved around the wire. By arranging the tapes at a different pitch the winding may be made heavier or lighter, as may be desired.

Telegraph insulator; Samuel Oakman, of Melrose, Mass., assignor to the American Insulator Co., of New York..... 288,360

This is a glass insulator provided with a broad interior band of weather-protected surface of insulating material between the exterior of the insulator and its supporting peg.

All Persons Sending for

Catalogues or ordering articles advertised in our columns will do us and our Advertisers both a great favor by mentioning that they saw the advertisement in

The Electrical World.

CAT-HEAD CARDS.—Lovely set, 4 designs. Mailed on receipt of 5c. HEARNE & CO, Box 1487. N. Y.

Pride, Fraleigh & Kyle Telegraph Engineers Electricians and Contractors, 23 and 25 Dey Street, New York.

EVERYTHING

Relating to ELECTRICITY for sale, and Electrical work done. J. F. FAIRMAN, Cooper Union, N. Y.

Telegraph and Electrical SUPPLIES

Medical Batteries, Inventors' Models, Experimental Work, and fine brass castings. Send for catalogue C. E. JONES & BRO. Cincinnati, O.
It is important to us that you mention this paper.

CONSULTING CHEMIST AND ELECTRICIAN.—Analysis of all commercial and technical products. Investigations made on all questions bearing on electricity. Full information and prices mailed free on application. JAMES H. STEBBINS, JR., S. B., F. C. S., 117 Pearl St., New York.

SHORT-HAND

Writing thoroughly taught by mail. Terms low; satisfaction guaranteed. Send stamp for circular and specimen of writing.
W. W. HULTON, Stenographer, Pittsburgh, Pa.

A LARGE IMPORTED FRINGE CARD or a set of four Christmas cards for 12 cents in stamps. NATIONAL CARD CO., 159 West Street, Brooklyn.

Bell Telephone Stocks

Bought and sold by J. O. SHIRAS, No. 11 West Third Street, Cincinnati, O.
MONEY LOANED ON TELEPHONE STOCKS.

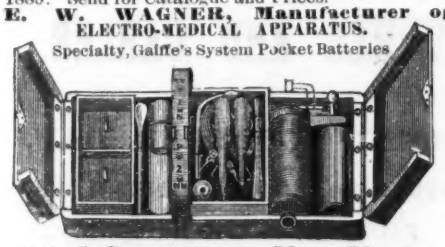
"A DAY IN NEW YORK, AND WHERE TO SPEND IT."—A neat little 48 pp. book, illustrated with fifteen engravings of the principal buildings, with description of each, so the visitor may know at a glance the principal places of interest, "where to find recreation and pleasure," the best hotels and restaurants, railroad depots, and matters important to every stranger. Sent by mail for 10 cents, stiff boards 15 cents, in stamps or postal note. NATIONAL CARD CO., 159 West St., Brooklyn.

WALLACE METCALF. R. G. ANDERSON.

METCALF & ANDERSON,
Mechanical, Electrical Engineers and Draughtsmen.
MORSE BUILDING, 140 NASSAU ST.

Special Inducements Offered in Drawings of Mechanical and Electrical Inventions. Working Drawings for Machinists and Pattern Makers. Foreign and Domestic Patent Office Drawings. Tracings, Blue-prints, etc. And all styles of Artistic Designing.

Awarded First Medal at Cincinnati Exposition, 1880. Send for Catalogue and Prices.
E. W. WAGNER, Manufacturer of ELECTRO-MEDICAL APPARATUS.
Specialty, Gaiffe's System Pocket Batteries



36 John Street, New York.

READY SHORTLY.

ELECTRICITY, MAGNETISM AND ELECTRO-TELEGRAPHY.

A Practical Guide for Students, Operators and Inspectors, by

THOMAS D. LOCKWOOD,
With 158 Illustrations.

D. VAN NOSTRAND,
Publisher, 23 Murray and 27 Warren Sts., N. Y.
Complete Catalogue of Electrical Works will be sent to any address on application.

JOHN B. SABINE,

ATTORNEY AND COUNSELOR-AT-LAW. NOTARY PUBLIC
(ROOM 20),
102 Broadway, New York.

Companies incorporated at $20 to $100, ex. office fees.
Letters patent obtained at $20 to $65, ex. office fees.
Titles searched at 1 per cent. of the value of the property.
Collections made at 10 per cent.
Contracts, assignments, etc., drawn at $5 to $25.
Deeds, mortgages, etc. drawn at $3 to $30.
Wills drawn at $5 to $40.
Special terms for general assignments and compositions.
Special attention given to Patents for Electrical Inventions, and to litigation concerning the same. Correspondents in all parts of the country.

ON TRIAL

French Battery for the cure of **Rheumatism, Neuralgia and Nervousness.** Send for circular.
C. E. JONES & BRO. Cincinnati, Ohio.
It is important to us that you mention this paper.

—1883.—

ALL THE VERY LATEST AND BEST IMPROVED FORMS OF

Telegraph Instruments, Batteries and Supplies

ARE FULLY DESCRIBED IN OUR

New, Large Illustrated Price List FOR 1883,

which we will send free and post-paid to any address upon receipt of request.

J. H. BUNNELL & CO.,
112 Liberty St., New York.

JUST PUBLISHED.
Fully Illustrated. Price, $3.00.

PHILIP REIS:

Inventor of the Telephone.

A Biographical Sketch, with documentary testimony, translations of the original papers of the Inventor and contemporary publications. By SILVANUS P. THOMPSON.

Catalogue of Electrical Books free on application

E. & F. N. SPON,
35 MURRAY STREET, NEW YORK.

All Kinds of Apparatus for Elementary Study of Electrical Science.

A SCIENTIFIC NOVELTY—The Student's Electrical Cabinet — Designed to accompany CURT W. MEYER'S **"Elementary Guide in Electricity."** The apparatus will illustrate the heating power of electricity by igniting gas, ether, alcohol, firng electric cannon, etc.; will electrify any number of persons joining hands, and will also illustrate most of the phenomena of electric attraction, repulsion and induction. A brilliant spark, *one* inch, can be produced, showing the electric light in *vacuo*, and illustrating the principles of lightning. The apparatus will furnish the student ample means to perform any known experiment of this most amusing science. Complete Apparatus, $15, including Electrical Machine.
CURT W. MEYER, 11 Dey St., N. Y.

INSURES AGAINST ACCIDENTS AT HALF THE RATES OF STOCK COMPANIES.

$70,000,000 of Insurance in Force.
Not One Dollar of Indebtedness.
2,000 Claims Paid. Not One Unpaid.

Membership Fee, $4; Annual Cost About $12 for $5,000 Accident Insurance, with $25 Weekly Indemnity.

$10,000 Insurance, with $50 weekly Indemnity, at corresponding rates.

HOW TO BECOME A MEMBER:

Write for Circular and Application Blank, and when received, fill out your application, inclose $4, and forward it to the Secretary at New York, on receipt of which a policy will be promptly mailed to you.

CHARLES B. PEET (of Rogers, Peet & Co.), President.
JAMES R. PITCHER, Secretary.

THE CONSOLIDATED TELEPHONE CO are now ready to sell telephones, make territorial contracts, etc. This system is no infringement of existing patents, and the Company have no lawsuits pending. Correspondence looking toward local organizations desired. Call and see telephones working, or address Company at offices, No. 18 Broadway, rooms 505 and 506.

VIADUCT MANUFACTURING CO.,

OF
BALTIMORE CITY.

WORKS:
RELAY STATION, B. & O. R. R.
OFFICE:
CHAMBER OF COMMERCE,
ROOMS 29 AND 31.

This company, in connection with its present affairs, will continue the business of the late firm of

DAVIS & WATTS,

to which it has succeeded, the latter firm having dissolved, and Mr. Augustus G. Davis, its senior member, having assumed its entire assets and liabilities.

Mr. Davis has transferred to this company (of which he is president)

All Interests of Whatever Nature heretofore pertaining to Davis & Watts, and will henceforth give his personal supervision to the manufacture of electrical goods of every description.

Having increased facilities and ample capital, we will carry a large stock of

Telephone, Telegraph, Electric Light,

and American district supplies of all kinds.

Our works are on the Patapsco River, at the Relay Station, B. & O. R. R., with an abundance of water power.

We carry continually a large stock of **Cross-Arms, Pins, Brackets, Insulators and Wire** (both line, office and electric light), and our prices will be found **most reasonable.**

We solicit a continuation of the favors heretofore extended by customers to the late firm of Davis & Watts, in the assurance that we can and will make it **to their advantage.**

We have in preparation A NEW ILLUSTRATED CATALOGUE, which, when ready, we shall be pleased to furnish.

VIADUCT MANUFACTURING CO., A. G. DAVIS, President.

SPIRAL TELEPHONE WIRE.

Patents allowed April 20 and July 2, 1883.

UNLIMITED DISTANCE TELEPHONY!

CLEAR ARTICULATION

Over Long and Short Lines!

Long line wires may be tested at the offices of this company, in comparison with ordinary wires on the same poles of the American Bell Telephone Company.

The Patents on the Spiral Wire were only granted after absolute comparative tests at Washington.

TELEPHONE COMPANIES

And Others Having Bad Service Wires

Can Arrange for Perfect Service.

No. 13 spiral wire weighs only 110 lbs. to the mile.

FOR ALL DISTANCES,

Instantaneous Reproduction Without Exertion
Address Orders for wire to

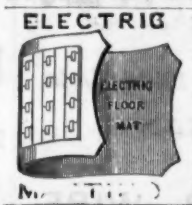
American Spiral Telephone Wire Company,

43 MILK STREET,
BOSTON MASS.

ESTABLISHED 1859.

PLATINUM.

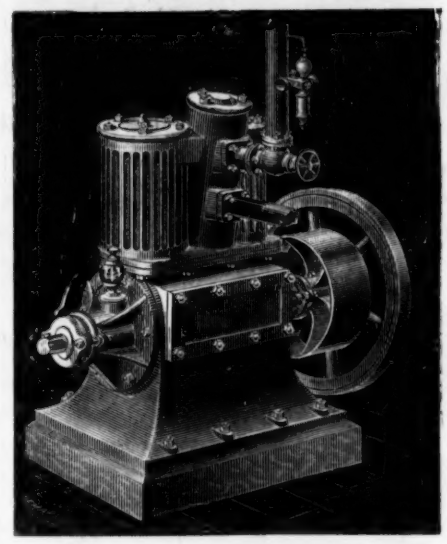
H. M. RAYNOR,
25 BOND STREET, New York.



THE N.Y. APPLEGATE Electric Matting Co.

Invisible Electric Alarm Matting Appliances. Send for circular. Office, Mills Building, 35 Wall Street, New York.

The Westinghouse Automatic Engine.



The best evidence of its peculiar merit is the fact that our shipments average **two engines per day!** Over **600 engines in operation!** Our prices are moderate. Send for Illustrated Circular and Reference List. **THE WESTINGHOUSE MACHINE COMPANY, Pittsburgh, Pa.** Branch Offices: 94 Liberty Street, New York; 14 South Canal Street, Chicago; 401 Elm Street, Dallas, Texas.

Stabler Individual Call.

SOME OF ITS ADVANTAGES.

1st. It calls any subscriber on a circuit line without sounding the bells of the others.

2d. It gives each subscriber, while using the line, entire privacy and freedom from interruption.

3d. It shows every subscriber at a glance, by the position of the index, whether or not the line is in use.

4th. It is very simple in construction, easy of manipulation and rapid and reliable in action, the instruments being *automatically* maintained in unison.

5th. It is operated without clock-work—by impulses direct from the generator at the Exchange, and is under exclusive control of the operator.

6th. It relieves the subscriber of any duty but to answer his calls, and renders it impossible for him to interfere with others through ignorance or neglect.

7th. It is exclusively a magneto call, requiring no battery, and combines, in a very handsome box but little larger than the ordinary magneto bell, the individualizing apparatus, local generator for calling Exchange, bell and telephone switch.

8th. It works equally well over long or short lines (from short circuit to 2,000 ohms), and no change of adjustment in the bells is required when additional ones are looped into a circuit already established.

9th. One Central Office instrument and generator can be used on any number of circuits by switching from one to another.

A practical test of this call was made on one of the busiest lines of the Washington, D. C., Exchange, which lasted continuously from December, 1882, to June, 1883, giving entire satisfaction to both the subscribers and Telephone Co., and developing the entire reliability of the system under all atmospheric conditions.

Sets of the apparatus furnished for trial on application to

THE STABLER SIGNAL CO.,
P. O. Box 388, WASHINGTON, D. C.

CEDAR TELEGRAPH POLES,

FROM 25 TO 60 FEET IN LENGTH.

Seasoned ready for immediate delivery. The Largest and Best Selected Stock in Michigan. We quote prices delivered at any Railroad Station in the United States.

BROWNLEE & CO., DETROIT, MICH.

ALFRED F. MOORE,

MANUFACTURER OF

Insulated Wire

FOR

Telephone, Telegraph and Electric Light,

OFFICE, LINE,

AND

ANNUNCIATOR WIRE,

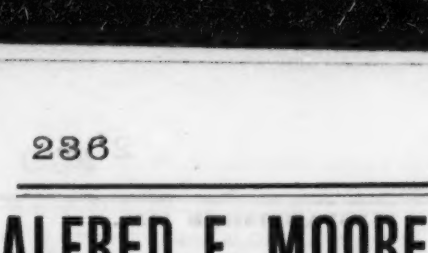
Magnet Wire and Flexible Cordage,

200 & 202 N. THIRD STREET,

PHILADELPHIA, PA.

PALMER WIRE CO.,

PALMER, MASS.



TELEGRAPH

AND

TELEPHONE

WIRE,

As Good as the best. Special care taken in its manufacture.

Write us for prices before ordering elsewhere.

NOW READY.

ELECTRICAL MEASUREMENT,

AND

The Galvanometer and Its Uses.

BY T. D. LOCKWOOD.

144 pages, handsomely bound, large clear type, and fully illustrated with diagrams of connections, engravings of apparatus, etc.

Price, $1.50. Sent by mail, post-paid, to any address upon receipt of price.

Every Telegraph Office Manager or Telegraph Operator, Every Telephone Central or District Telegraph Manager, Every Student of Electrical Science, Every Person having charge of Electric Light Plant, or other Electrical Arrangements and Apparatus, and every Person who takes an interest in Electrical Matters of any kind should read

T. D. LOCKWOOD'S

"Electrical Measurement and the Galvanometer."

It is the only book which *explains* in *plain English*, and *without algebraic formulæ*, all about *Electrical Measurement* and *the Use of Galvanometers*, besides giving fully detailed and illustrated descriptions of

GALVANOMETERS AND RHEOSTATS,

With all diagrams of connections required in using them, and the plain and simple *reason why* for everything.

In this remarkable book the whole subject of Electrical Measurement is made so clear and plain that *any one* can easily understand every explanation, and can practically make electrical measurements without difficulty, and especially without "doing" sums in algebra.

PUBLISHED BY

J. H. BUNNELL & CO.,

112 Liberty Street,

NEW YORK,

To whom all Orders should be sent.

JUST OUT!

ELECTRICITY

IN THEORY AND PRACTICE;

OR, THE ELEMENTS OF

ELECTRICAL ENGINEERING.

BY LIEUT. BRADLEY A. FISKE, U. S. N.

270 Octavo Pages. 180 Illustrations.

$2.50. PRICE $2.50.

This book commends itself to Electricians and the Students of Electricity, because it aims to form a bridge between the many works written on the theory of electricity, and the many works written on its practical applications. Its practical value will be seen from the following

TABLE OF CONTENTS.

CHAPTER I.—MAGNETISM.—The Lodestone—Artificial Magnets—Poles of Magnets—North and South Seeking Poles—Magnetic Attraction and Repulsion—The Earth a Large Magnet—Magnetic Substances—Methods of Imparting Magnetism—Point of Saturation—Coercive Force—Electro-Magnets—Magnetic Induction—Strength of a Magnet-Pole—Measurement of Magnetic Force—Torsion-Balance—Method of Oscillations—Broken Magnets—Lines of Force—Magnetic Field—Mathematical Explanation of Curves of Lines of Force—Comparative Strength of Magnetic Attraction and Magnetic Repulsion—The Compass—Dip.

CHAPTER II.—FRICTIONAL ELECTRICITY.—Electrical Attraction and Repulsion—Negative and Positive Electricity—Simultaneous Production of Positive and Negative Electricity—Charge—Conductors and Insulators—Quantitative Laws of Attraction and Repulsion—Unit of Electricity—Electric Induction—Inductive Capacity—Electricity resides upon the Surface—Electric Density—Leyden Jars, or Condensers—Electrical Machines—The Plate Machine—The Holtz Machine—Other Methods of Producing Electricity—Atmospheric Electricity.

CHAPTER III.—WORK AND POTENTIAL.—Definition of Work—Unit of Work—Electric Potential—Electrification by Contact—Sir William Thomson's Electrometer.

CHAPTER IV.—VOLTAIC BATTERIES.—Simple Voltaic Couple—Polarization—Means of Preventing—Mechanical Means: Smee's Battery—Chemical Means—Electro-Chemical Means—Single-Fluid Batteries—The Bichromate Battery—Leclanché Battery—Two-Fluid Batteries—Daniell's—Gravity—Grove's—Bunsen's.

CHAPTER V.—LAWS OF CURRENTS.—Electromotive Force—Strength of Current—Resistance—Ohm's Law—Unit Strength of Current—Unit Quantity of Current—Unit of Resistance—Laws of Resistance—Capacity—Unit of Capacity—Practical Units—Practical Units of Potential; of Resistance; of Quantity; of Capacity—Simple Circuits—Grouping of Cells—Long and Short Coil Instruments—Branch or Shunt Circuits—Development of Heat by Currents—Joule's Equivalent—Electrolysis—Ions—Laws of Electrolysis—Electrical Writing—Electrotyping—Electroplating.

CHAPTER VI.—SECONDARY OR STORAGE BATTERIES.—Laws Governing Electric Storage of Energy—Grove's Gas-Battery—Planté's Secondary Battery—Faure's Battery—Batteries of Sellon, Swan, Brush, Kabath, Maloney and Koyl, Eaton, Starr, Finney, Haid, Edison, Keith—Electromotive Force and Chemical Force.

CHAPTER VII.—THERMO-ELECTRIC BATTERIES.—General Description—Prospects of Thermo-Electricity—Batteries of Brard, Jablochkoff, Higgs, Randall, Patterson, Wallace and Davies.

CHAPTER VIII.—ELECTRO-MAGNETISM.—Magnetic Nature of Electric Currents—Electro-Magnets—Positive and Negative Directions of Lines of Force—Ampère's Theory of Magnetism—Action of Currents on Magnetic Needles—Deflection of Conductors by Magnet-Poles—Magnetic Actions of Currents on each other—Forms and Proportions of Electro-Magnets—Electric Bells.

CHAPTER IX.—INDUCTION-CURRENTS.—General Description of Phenomena—Direction of Induced Currents—Unit Electromotive Force of Induced Currents—Induction of Currents by Currents—Induction-Coils—Extra Currents; Self-Induction—Ruhmkorff's Coil.

CHAPTER X.—ELECTRICAL MEASUREMENTS.—Galvanometers—The Sine Galvanometer—The Tangent Galvanometer—The Differential Galvanometer—Sir William Thomson's Mirror Galvanometer and Marine Galvanometer—The Ballistic Galvanometer—Ammeters—The Deprez Ammeter—Ayrton and Perry's Ammeter and Voltmeter—Ayrton and Perry's Spring Ammeter and Voltmeter—Ayrton and Perry's Wheel and Pinion Ammeter and Voltmeter—Voltameters—Zinc Voltameters—Measurement of Resistance—Methods with Sine and Tangent Galvanometers—Differential Method—Wheatstone's Bridge—Rheostats and Resistance-Coils—Battery Measurements—Measurement of Internal Resistance and Electromotive Force—Measurement of Capacity.

CHAPTER XI.—TELEGRAPHY.—General Description—The Sounder—The Relay—The Polarized Relay—The Key—The Register—Multiplex Telegraphy—Duplex Systems—Quadruplex Systems—Harmonic Telegraphy—Speed of Signaling—Retardation; Electro-static Charge—Retardation on Land Lines—Automatic Telegraphy—General Description—The Leggo System—Autographic Telegraphy.

CHAPTER XII.—THE TELEPHONE.—Reiss' Musical Telephone—Bells Theories—Undulatory Currents—Bell's Telephone—Edison's Transmitter—Edison's Motograph Receiver—Induction Transmitters—The Microphone—Induced Effects—Theories of the Microphone—Limited Telephonic Transmission—Submarine and Underground Telephone Lines.

CHAPTER XIII.—THE ELECTRIC LIGHT.—Arc Lights—Regulators—Arc Lights in Series—Differential Lamps—Clutch Lamps—Clock-work Lamps—Jablochkoff Candles—Incandescence-arc Lamps—The Soleil Lamp—Incandescence Lamps—Starr's Lamp—Edison's, Maxim's, Swan's, and Lane-Fox's Lamps.

CHAPTER XIV.—ELECTRIC MACHINES.—General Principles—Different Classes of Machines—Commutators—Alternate-Current Machines—Continuous-Current Machines—Edison's Machine—Weston's Machine—Gramme's Machine—The Brush Machine—Excitation of Field-Magnets—Different Methods of Excitation—"Characteristic" Curves of Dynamos.

CHAPTER XV.—ELECTRO-MOTORS.—Analysis of Action—Different Forms of Motors—Different Dynamos used as Motors—Direction of Rotation of Different Types—Counter Electromotive Force—Regulating Electro-Motors—Ayrton and Perry's Regulator—The Electric Hammer.

CHAPTER XVI.—ELECTRIC DISTRIBUTION OF POWER.—General Principles—Electrical Work—Unit of Electrical Work—Electrical Horse-Power—Table of C. G. S. and English Units—Transmission of Power—Radiation of Heat by Conductors—Different Systems of Electric Distribution—Series System—Multiple-Arc System—Multiple-Series and Series-Multiple Systems—Accumulator System—Motor-Dynamo System—Induction System—Advantages and Disadvantages of each System—Maintenance of Constant E. M. F.—Size of Conductors; Sir William Thomson's Rule—Generative Efficiency of Machines; Silvanus Thompson's Rules—Lead of Brushes—Electrical Efficiency of Machines; Formulas therefor—Efficiency and Maximum Power of Motors; Formulas therefor—Arrangement of Accumulators.

CHAPTER XVII.—METERS.—Necessity for Meters—Edison's Meters—Ayrton and Perry's Erg-Meter—The Siemens Power Meter—Ayrton and Perry's Ohmmeter.

CHAPTER XVIII.—ELECTRIC RAILWAYS.—The Conductor and the Accumulator Systems—General Advantages of Electric Railways—Railway in the Mines of Zankerode—Siemens Railways in Berlin—Electric Street-Cars—Systems of Siemens and Field—The Portrush Railway—The Accumulator System as tried in London—Calculations of Horse-Power, etc.

The book is now ready, and copies will be mailed, postage prepaid, on receipt of the price. Address either

D. VAN NOSTRAND, Publisher,
23 Murray St., and 27 Warren St., New York;

OR,

W. J. JOHNSTON, Publisher and Bookseller,
No. 9 Murray Street, New York,

From whom copies of any book published by D. Van Nostrand can always be obtained at publisher's prices.

THE AMERICAN BELL TELEPHONE COMPANY.

W. H. FORBES, President. W. R. DRIVER, Treasurer. THEO. N. VAIL, General Manager.

This Company, owning the Original Patents of Alexander Graham Bell for the Electric Speaking Telephone, and other patents covering improvements upon the same, and controlling, except for certain limited territory, under an arrangement with the Western Union Telegraph Company, the Gold and Stock Telegraph Company, the American Speaking Telephone Company, and the Harmonic Telegraph Company, the patents owned by those companies, is now prepared to furnish, upon application, either directly or through any of its agents, Telephones of different styles, and applicable to a variety of uses.

This company desires to arrange with persons of responsibility for establishing

District or Exchange Systems,

in all unoccupied territory, similar to those now in operation in all the principal cities in this country.

Responsible and energetic persons are required to act as licensees for the purpose of establishing

PRIVATE LINE AND CLUB LINE

systems, for business or social uses. Also to introduce the telephone for

SPEAKING TUBE

purposes, for which instruments will be leased for a term of years at a nominal rental.

This Company will arrange for telephone lines between cities and towns where Exchange systems already exist, in order to afford facilities for personal communication between subscribers or customers of such systems.

We respectfully invite attention to this matter, and any further information relating thereto can be obtained from the Company,

No. 95 Milk Street, Boston, Mass.

All persons using Telephones not licensed by this Company are hereby respectfully notified that they are liable to prosecution, and for damages for infringement, and will be prosecuted accordingly to the full extent of the law.

CHARLES WILLIAMS, JR.

(ESTABLISHED IN 1856)

109 Court Street, Boston, Mass.,

AUTHORIZED MANUFACTURER OF

THE AMERICAN

BELL TELEPHONE CO.

Magneto, Crank and Push Button Call Bells, Electric Bells, District Bells and Switches for Exchanges, Annunciators, etc.

Telegraph and Electrical Instruments, Batteries, Wire, Insulators, and Telephone Supplies of every Description.

DAY'S

KERITE INSULATED

Telegraph, Telephone and Electric Light

WIRES AND CABLES,

MANUFACTURED ONLY BY THE INVENTOR,

AUSTIN GOODYEAR DAY,

OFFICE: 120 BROADWAY, NEW YORK.

FACTORY: SEYMOUR, CONN.

KERITE INSULATION should be used on electrical conductors for any of the following purposes:

Submarine, Underground or Aerial Telegraph, Telephone and Electric Light Cables; Office Cables and Lines; also for Battery, Burglar Alarm, Fire Alarm, Police and Submarine Blasting Purposes,

or for any other operation which requires perfect, indestructible and permanent insulation of electric wires.

A large number of

ANTI-INDUCTION KERITE TELEPHONE CABLES,

some of them TWO MILES IN LENGTH, are in use in several cities, and are found to WORK PERFECTLY for that distance.

Kerite is recommended and indorsed by all leading men connected with telegraphy, telephony, and electric lighting.

At the CENTENNIAL EXHIBITION at Philadelphia, Sir WILLIAM THOMSON, the eminent Electrician and Scientist, awarded to the

Kerite Insulated Wire and Cables

A DIPLOMA

For "Excellence of the Insulation and Durability of the Insulator."

For Sale by all Dealers in Telegraphic Materials.

CLARK B. HOTCHKISS, Gen. Agt.

120 Broadway, New York.

"ELECTRIC GAS LIGHTING DEPARTMENT"

OF

THE ELECTRICAL SUPPLY CO.,

NEW YORK.

NEW YORK, Nov. 7, 1883.

DEAR SIR:

The statements made by the Electric Gas Lighting Company of Boston, in a printed circular dated Oct. 25, 1883, to the effect that a certain contract entered into by and between The Electric Gas Lighting Company and ourselves had been terminated by their notice to us for "alleged non-fulfillment and violation of its terms, conditions and covenants," makes necessary a brief statement of facts to the public by us in this matter.

The apparent grounds for such statement by the Electric Gas Lighting Company appears in the last paragraphs of the notice above alluded to, and are as follows: "But its failure to furnish the apparatus according to contract, and the small amount which it did furnish while said contract was in force, was so defective in construction, and inferior in quality, that it became our imperative duty," etc.

By our contract with the E. G. L. Co. we agreed to manufacture and sell gas-lighting apparatus according to the instructions, specifications and samples furnished by them. The necessary tools, dies and machines to accomplish this purpose on a large scale having been manufactured, and expert operatives got together, the goods were as rapidly produced as it was possible to make them, when it was found that the samples furnished us as patterns were not operative but defective; and from time to time we were variously instructed by that company to alter and change the burners as circumstances suggested. Without hesitation, and at a large cost to ourselves, we have complied with all these directions, till finally, from this excessive experience, more being due to the patience and skill of our "manufacturing electricians" than to the instructions received, the gas-lighting apparatus has been fully perfected, and such goods as we now ask our friends to purchase are perfect, and will do their work thoroughly, and we guarantee in the future as in the past, each and every article manufactured by us in this line.

Having been advised that there is no ground for the abrogation of the contract, and that our rights to manufacture the goods are unimpared, we shall proceed in the manufacture and sale of the same—there being ample provision for so doing under our contract, irrespective of the notice of the E. G. L. Co., and we will not only guarantee to the purchaser the quality of the goods, but the purchasers and users themselves against any action proceeding from the Electric Gas Lighting Co. for restraint or for damages by reason of such purchase or use.

Under this contract the Electric Gas Lighting Co. has no right to manufacture or sell under their patents without infringement on our exclusive right, and we hereby forbid the manufacture of gas-lighting apparatus under the patents covered by our contract, as an infringement of our exclusive rights, and we shall hold all such manufacturers, purchasers and users to a strict accountability in damages.

The intelligent purchaser—be he dealer or user—will not be misled by any one-sided statement in this matter. Soliciting your correspondence for the purchase and sale of these goods, and calling your attention to our special list No. 33, herewith accompanying, We remain,

THE ELECTRICAL SUPPLY CO.,

FACTORY—ANSONIA, CONN. **17 Dey Street, New York.**

TO THE PUBLIC.

NEW YORK, Nov. 27, 1883.

On the 7th of November, in answer to a circular of the Electric Gas Lighting Co., of Boston we issued a copy of the above. Having just noticed that the same Company, in "The Electrical World" of 17th inst., once more publish their original circular, we take this method of again denying the statements and charges of that Company, and to say, in addition, that we solicit orders for Electric Gas Lighters upon the same conditions as those above noted, and also that we will prosecute to the full extent of the law all parties found manufacturing or using the goods covered by the patents represented in the above-named contract.

THE ELECTRICAL SUPPLY CO.,

17 Dey Street, New York.

HOLMES, BOOTH & HAYDENS,

MANUFACTURERS OF

FIREPROOF INSULATED ELECTRIC LIGHT WIRE

From Pure Lake Superior Copper. Conductivity Guaranteed.
Patent "K. K." Insulated Copper and Iron Wire, for Telephone and Telegraph Use.

49 CHAMBERS ST., N. Y. WORKS: WATERBURY, CONN. 18 FEDERAL ST., BOSTON.

ELECTRICITY!

EVERY FAMILY SHOULD HAVE ONE OF

DR. JEROME KIDDER'S

Electro-Medical Apparatuses

THEY ARE THE BEST, owing to the Simplicity of Operation, Durable Construction and Physiological Qualities of Electricity they produce.

DISEASES CONQUERED!
THE ENEMY ROUTED!

Why suffer from the effects of Rheumatism, Gout, Neuralgia, Paralysis, Dyspepsia and Nervous Diseases, when you can procure the only positive eradicator of diseases and promoter of health?

Our superior Electro-Medical Apparatuses *have stood the test, and are pronounced invaluable as remedial agents.*

The public should be on their guard against the many so-called Electric Belts, Bands, Armadillos, Brushes and Garments, as they are made to deceive the public, and not for their so-called Electric Currents.

To distinguish the genuine from the spurious, send for a copy of the "Electro-Allotropic Physiology," mailed free.

Address JEROME KIDDER MANUFACTURING CO., 820 Broadway, New York City.

THE ANSONIA BRASS & COPPER CO.,

MANUFACTURERS OF

Pure Electric Copper Wire,

For Magnets, Telephones, Electric Lights, Etc.

With H. Splitdorf's Patented Liquid Insulation, covered with Cotton or Silk.

LINE WIRE.

Fire-Proof House and Office Wire for Indoor Use in Electric Lighting
Wrought Metal Gongs, for Annunciators, Telephones, Etc. Zinc Rods, Battery Copper, Etc.

NOS. 19 & 21 CLIFF STREET, NEW YORK.

GEORGE WESTINGHOUSE, Jr., President. ROBERT PITCAIRN, Treasurer.
C. H. JACKSON, Vice President and General Manager. ASAPH T. ROWAND, Secretary.
HENRY SNYDER, General Agent.

THE UNION SWITCH AND SIGNAL CO.,

PITTSBURGH, PENNA.,

A CONSOLIDATION OF

THE UNION ELECTRIC SIGNAL CO., Of Boston, Mass. AND OF THE INTERLOCKING SWITCH & SIGNAL CO. Of Harrisburg, Pa.

SOLE OWNERS AND MANUFACTURERS OF THE ONLY PRACTICALLY SUCCESSFUL SYSTEM OF

OPERATING RAILROAD SIGNALS AUTOMATICALLY

ALSO OF

APPARATUS FOR OPERATING AND INTERLOCKING SWITCHES, SIGNALS AND GATES BY LEVERS, HYDRAULICS, PNEUMATICS OR ELECTRICITY.

ALSO MANUFACTURERS OF

FROGS, CROSSINGS, SWITCHES AND SWITCH STANDS.

☞ Plans, estimates and detailed descriptions, together with references to apparatus in practical operation, will be furnished upon application.

Office and Works, Corner Fayette Street, Garrison Alley and Duquesne Way.

The Suffolk Electric Mfg. Co.,

28 SUDBURY ST., BOSTON,

MANUFACTURERS OF

Electric Bells, Striking Gongs, Annunciators, Burglar Alarms, Push Buttons, Switches, Keys, Spark Coils, Batteries, Electric Gas Lighting, and Specialties of all kinds.

THE BUTLER HARD RUBBER CO.

Electrical Supplies,

33 Mercer St., New York.

Manufacturers of

Sheet Rubber, Rods, Tubing, Etc.,

RUBBER HOOK INSULATORS.

Key Knobs, Switch Handles, Magnet Covers, Magnet Heads, Window Tubes, with Heads, Battery Cells, Battery Syringes, And Specialties of any Required Character.

BOSTON AND SANDWICH

GLASS CO.

OFFICE AND SAMPLE ROOMS,

No. 17 MURRAY ST., N. Y.

REPRESENTED BY

C. E. L. BRINKERHOFF.

J. H. LONGSTREET,

No. 9 Barclay Street,

NEW YORK,

MANUFACTURER AND DEALER IN

TELEGRAPH INSTRUMENTS,

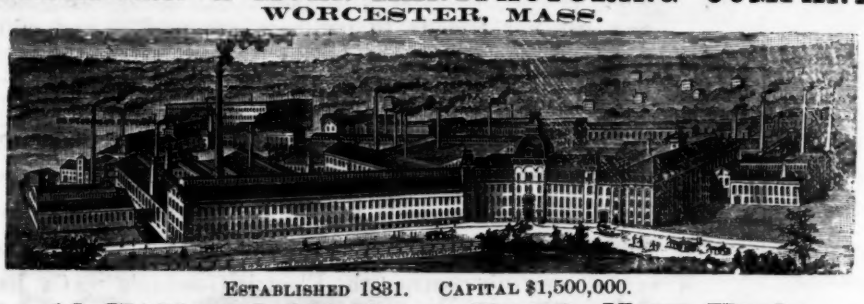
Telephone and Telegraph Supplies OF EVERY DESCRIPTION, ANNUNCIATORS AND BURGLAR ALARM APPARATUS, BATTERIES AND BATTERY MATERIAL.

Telegraph Instruments for Railroad Use a Specialty.

TELEGRAPH WIRE. TELEPHONE WIRE.

WASHBURN & MOEN MANUFACTURING COMPANY

WORCESTER, MASS.



ESTABLISHED 1831. CAPITAL $1,500,000.

16 Cliff and 241 Pearl Street, New York.
215 Lake Street, Chicago.

This Company having given careful attention to Telegraph Wire from the introduction of the Art of Telegraphy, and especially with reference to the conditions necessary to *highest electric conductivity*, does not hesitate to recommend this class of its products as unequaled in that particular. Being the first to

MAKE A SPECIALTY OF TELEGRAPH WIRE

and anticipating at an early day the great demand that would exist for that article, they well adopted and fully proved certain methods and appliances for the production of Telegraph as have as of Telephone Wire which are peculiar to themselves. Among them may be mentioned the

PATENT CONTINUOUS ROLLING MILL, PATENT CONTINUOUS GALVANIZING BATH, AND THE BELGIAN ROLLING MILL.

(In connection with the DOUBLE SIEMENS FURNACE).

All Wire made by this Company for Telegraph or Telephone purposes is thoroughly tested before shipping, with regard to Conductivity, Tensile and Torsion strength, as well as Elongation.

Prices and terms for Telegraph or Telephone Wire—Plain, Oiled or Galvanized—given upon application.

N. B.—The qualities known as extra Best (E. B. B.) and Best Best (B. B.) kept constantly in stock.

Telegraph and Electrical SUPPLIES

Medical Batteries, Inventors' Models, Experimental Work, and fine brass castings. Send for catalogue **C. E. JONES & BRO. Cincinnati, O.**

It is important to us that you mention this paper.

TELEGRAPH AND TELEPHONE POLES.

65,000 25 to 60 feet. No. 1 Quality.

These Poles are Live Timber, well seasoned, and in every way desirable. Deliverable on line of F. & P. M., Mack. Div. M. C., P. O. & Pt. Austin Railroads.

Electric Light, Railroad, Telegraph and Telephone Companies supplied. Prompt delivery.

HENRY C. RIPLEY,
EAST SAGINAW, MICH.

HOSPITALIER.

SECOND EDITION NOW READY.

THE MODERN APPLICATIONS OF ELECTRICITY.

(2 VOLS)

BY

E. HOSPITALIER.

Sent Post-Paid on Receipt of Price, $8.00

ADDRESS

W J. JOHNSTON, Publisher,
No. 9 Murray St., N. Y.

THE KERNER STYLOGRAPHIC PEN

$1.00. $1.00.

Latest Improvement in STYLOGRAPHIC PENS. Flexible Air Tube. The Perfection of Action.

Buy no other, the KERNER is the only PERFECT Stylographic Pen made for the money, and challenges comparison with any $5.00 pen in the market. Ask your stationer for one, or send to

THE KERNER STYLOGRAPHIC PEN COMPANY,
25 BOND STREET, NEW YORK CITY.

LYMAN'S O. K. INSTRUMENTS.

No. 2 O. K. KEY.

The above Key is a perfect working key, and has *pure platinum points*. Finished Brass Lever and Rubber Knobs. Price, $1.45, C. O. D., subject to inspection.

No. 2 O. K. SOUNDER.

The above Sounder is warranted to work well where any sounder will. Price, $2.60, C. O. D., with privilege to examine before paying for it.

These are no Toy Instruments. We guarantee them to work well where any Key or Sounder will work. Both Key and Sounder lever are brass and nicely finished.

The above Sounder and Key (either on one base or separate, as ordered), one full-sized Callaud battery, 1 lb. vitriol, 15 ft. office wire, etc., all nicely packed and sent C. O. D., **$4.50**, with privilege to examine before paying for them.

If you want cheaper instruments, send 3 cent stamp, for our reduced price-list. Also agents for the STEVENS Top Contact, NON-PARALETIC KEY. Price, $3.50. Will fill all orders the same day we receive them. Address, mentioning this paper.

A. B. LYMAN & CO., 36 South Water Street Cleveland, O.

WESTERN ELECTRIC COMPANY.

CHICAGO, BOSTON, NEW YORK.

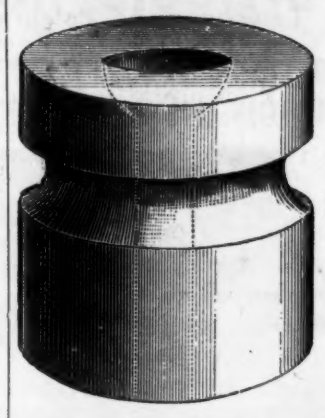
MANUFACTURERS OF

Telegraph Instruments and Supplies, Fire Alarms and Call Bells, Electro-Mercurial Gas-Lighting Apparatus, Magneto Call Bells, Telephone Exchange Switch Boards, etc.

UNDERGROUND AND AERIAL CABLES, AND TELEPHONE APPARATUS OF EVERY DESCRIPTION.

CORRESPONDENCE SOLICITED.

Hard Porcelain Insulators,



LARGE AND SMALL,

FOR

Telegraph, Telephone

AND

Electric Work.

UNION PORCELAIN WORKS,

300 Eckford Street,

GREENPOINT, N. Y.

The United Globe Electric Light Co.,

15 CORTLANDT STREET, NEW YORK.

We are now prepared to receive applications and furnish estimates of cost for **ARC LIGHTS of 2,000 NOMINAL CANDLE POWER with DYNAMO.**

Also applications for the formation of **LOCAL SUBSIDIARY COMPANIES.**

Allow liberal Commission upon all orders.

AGENTS WANTED EVERYWHERE.

Send for Circulars and information to

THE UNITED GLOBE ELECTRIC LIGHT CO.,

15 CORTLANDT ST., NEW YORK CITY.

ON TRIAL French Battery for the cure of Rheumatism, Neuralgia and Nervousness. Send for circular.

C. E. JONES & BRO. Cincinnati, Ohio.

It is important to us that you mention this paper.

PLATINUM.

JOHN H. MUEGGE,

MANUFACTURER OF ALL KINDS OF

Crucibles and Vessels. Plate, Wire, Foil and Sponge.

Scraps purchased.

No. 91 Liberty Street, New York.

BOOKHOUT BROS.

Engravers ON WOOD.

38 MAIDEN LANE

NEW YORK

MITCHELL, VANCE & CO.,

GAS FIXTURE MANUFACTURERS,

Have added a department for the Manufacture of Electroliers and other fixtures adaptable to any system of Incandescent Electric Lighting, also Combination Fixtures for both Gas and Electric Light.

Estimates and designs furnished upon application.

836 AND 838 BROADWAY,

NEW YORK.

THE BERGMANN & HAID BATTERY.

THE GREATEST OPEN-CIRCUIT BATTERY IN THE WORLD!

Height 6½ inches.
Diameter, 3¼ inches.

BERGMANN & CO.

Have now succeeded in supplying what has till now been the GREAT DESIDERATUM in Telephone and all open circuit work. This Battery is not only

The Simplest, Cleanest, Most Economical and Most Durable of All,

but it overcomes all the existing defects of the Leclanché and other forms hitherto employed.

It is Small, Neat, Compact and very Portable, Hermetically Sealed, and Guaranteed to form no Gases. On this account it requires hardly any attention.

IT WILL LAST MORE THAN TWICE AS LONG as any other. IT IS CHEAPER than any other.

PRICE CHANGED TO $1.20, COMPLETE.

Samples sent to dealers and telephone exchanges on application. Send for circular. Liberal Discounts to dealers.

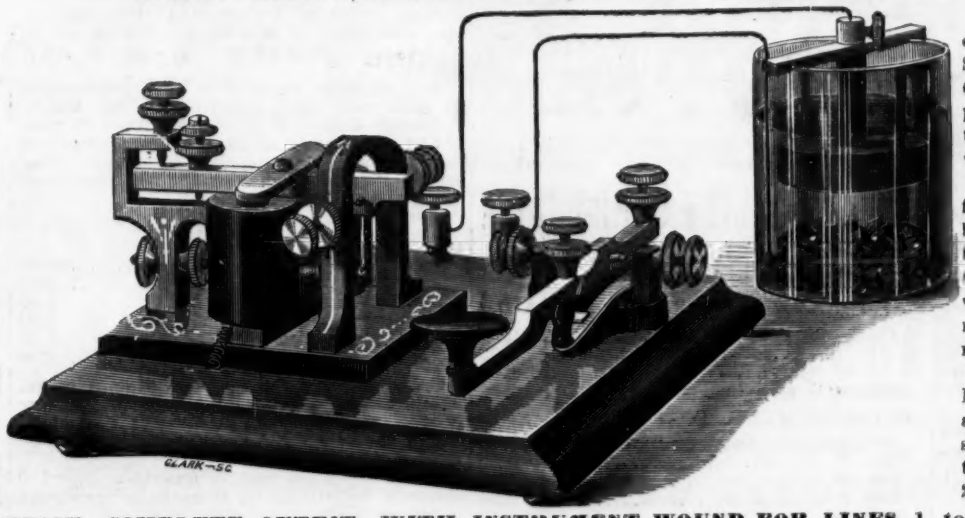
BERGMANN & CO.,

ELECTRICAL WORKS,

292 to 298 Avenue B, corner Seventeenth Street, New York.

PREMIUM APPARATUS. ONLY $5.00.

NOT THE CHEAPEST, BUT GUARANTEED THE BEST.



The PREMIUM APPARATUS AND OUTFIT comprises the famous "NEW GIANT SOUNDER PERFECTED," and the "NEW CURVED KEY," placed upon a splendidly polished base, with a cell of Callaud Battery, Chemicals, Office Wire, etc., for $5, when the money accompanies the order.

These instruments are the exact size and form of those upon which we received the highest award at the late Centennial Exhibition over all competitors, and *are not the common affairs so generally advertised*, which *are dear at any price*. Everything reliable, and so guaranteed, or money refunded.

Since the introduction of the "Premium Instruments we have sold thousands of them, and in every instance they have given entire satisfaction, whether used for home practice or for actual work on lines from 1 to 20 miles in length.

PRICE, COMPLETE OUTFIT, WITH INSTRUMENT WOUND FOR LINES 1 to 15 MILES, $5.00. INSTRUMENT WITHOUT BATTERY, $4.20.

Cell of Battery, Complete, 80 cents: Premium Sounder, Separate Base **$2.50**; Premium Key, Separate Base, **$1.75**; Premium Apparatus, Key and Sounder entirely Nickel plated without battery, **$5.20**; Complete Nickel-plated Instrument, with battery and outfit, **$6.00**; Sounder, Separate Base, **$3.25**; Key, **$2.00. Money in advance.**

Instruments without battery, sent by mail. 55 cents extra. Battery jars cannot be sent by mail. All orders will receive our prompt and careful attention. To prevent delay in shipment, full shipping instructions with town, county and State should be given. Remittances should be made by P. O. money order, registered letter, draft or express, which will insure safe delivery. Send for catalogues and circulars before purchasing elsewhere.

PARTRICK & CARTER,

(ESTABLISHED 1867).

MANUFACTURERS OF TELEGRAPH INSTRUMENTS AND SUPPLIES,

No. 114 South Second Street, Philadelphia.

JUST PUBLISHED!

PHILIPP REIS,

Inventor of the Telephone.

A BIOGRAPHICAL SKETCH,
WITH DOCUMENTARY TESTIMONY,
TRANSLATIONS OF THE ORIGINAL
PAPERS OF THE INVENTOR,
AND CONTEMPORARY
PUBLICATIONS,

BY

SILVANUS P. THOMPSON, B. A.

PROFESSOR OF EXPERIMENTAL PHYSICS IN UNIVERSITY COLLEGE, BRISTOL.

3 Plates and 48 Engravings, 8 vo. Cloth.

PRICE $3.

Contents.

Chap. I. Biography of the Inventor.—Chap. II.—The Inventor's Apparatus. (a) Transmitters, (b) Receivers.—Chap. III The claim of the Inventor. Chap. IV. Contemporary Documents.—Chap. V. Testimony of Contemporary Witnesses.

Appendix I Comparison of Reis' Transmitter with recent Instruments.—Appendix II On the Variation of Electric Resistance at a Point of Imperfect Contact in a Circuit.—Appendix III. Comparison of Reis' Receivers with recent Instruments.—Appendix IV. On the Doctrine of Undulatory Currents.

Schedule of Authorities and References. Additional References Concerning Reis' Telephone.

Lists of Illustrations.

Medallion portrait of the Inventor (from the medallion executed by Rumpf in 1873) and Autograph.—I. Vignette, Tomb of Philipp Reis, at Friedrichsdorf.—II. First Transmitter (the wooden ear), back view.—III. Front view.—IV. Side view—V. Section.—VI. Details.—VII. Second Transmitter (tin tube).—VIII. Third Transmitter (collar-box).—IX. Fourth Transmitter (bored block).—X. Section of same.—XI. Sixth Transmitter (wooden cone).—XII. Reis' Photograph of himself, holding the telephone (seventh form) in his hand.—XIII. Seventh Transmitter ("Hochstift" form).—XIV. Eighth Transmitter (lever form).—XV. Ninth Transmitter (transitional form).—XVI. Section of same.—XVII. Tenth Transmitter (square box.)—XVIII. Same opened.—XIX. First Receiver (violin form).—XX. Second Receiver (cigar box).—XXI. Third Receiver (electro-magnet).—XXII. Fourth Receiver (knitting-needle)—XXIII. The same.—XXIV. Curve of Condensation and Rarefaction in sound-wave.—XXV. Telephone ("bored block") shown to Physical Society of Frankfort-on-the-Main.—XXVI. Sound Curves.—XXVII. The same.—XXVIII. Facsimile Sketch from Reis' Letter to Mr. Ladd.—XXIX. The Telephone (from Reis Prospectus).—XXX. The same (from Muller-Pouillet's Physics).—XXXI. Details of Transmitter.—XXXII. Receiver.—XXXIII. The Telephone (from Pisko's Acoustics)—XXXIV. The same (from Kuhn's Handbook).—XXXV. Cone used in Transmitter.—XXXIV.—Metal Tympanium. XXXVII. Second Receiver (Cigar-box).—XXXVIII. Receiver with Lid.—XXXIX. Projected form of Receiver with Electro-magnet.—XL. The same.—XLI. Sketch of Experimental Transmitter.—XLII. Yeates' Receiver for Reis' Telephone.—XLIII. Berliner's Transmitter.—XLIV. Blake's Transmitter.—XLV. Comparative Series of Transmitters.—XLVI. Comparative Series of Receivers.—XLVII. Curves from Reis' Memoir "On Telephony".—XLVIII. Curves from Bell's Specification (U. S. Patent).

PLATE. I—Curves from Von Legat's Report on Reis's Telephone.—II. Reis' Telephone, from Von Legat's Report.

ELECTRICITY

AS A

Motive Power,

By COUNT TH. DU MONCEL AND FRANK GERALDY.

Translated and edited, with additions, By C. J. WHARTON.

110 ENGRAVINGS. CROWN 8 VO. CLOTH.

Price, - - - - - - - - $1.00

Contents:

INTRODUCTORY CHAPTER. Introduction—Principles on which the Construction of Electromotors is Founded.—Electro-magnets and their Construction.—Laws of Electro-magnets—Means Employed to Diminish the Detrimental Effects Produced in Electro-motors.

PART I.—FIRST PHASE OF ELECTROMOTORS—Chap. I., Historical Summary. Chap. II. Historical Motors. Chap III., Early Electromotors; I., Electromotors founded on the Dynamic properties of Currents; II., Electromotors founded on the attraction of Iron to Electro-magnets; III., Electromotors into which Gravity is introduced as a source of power. Chap. IV., Special application of Electromotors. Chap. V., Electro-chemical Motors.

PART II.—SECOND PHASE OF ELECTROMOTORS.—Chap. I., Reversible Machines. Chap. II., General Remarks on Modern Motors. Chap. III., Modern Small Motors. Chap. IV., Applications on Small Motors. Chap. V., First Applications of Transport of Force. Chap. VI., First Applications for the Locomotion of Carriages. Chap. VII., Transport of Force at the Electrical Exhibition of 1881. Chap. VIII., Recent Applications and Experiments. Chap. IX., The Distribution of Electricity.—Notes.

These books are now ready, and copies of either will be mailed, postage prepaid, on receipt of the rice.

Address either

E. & F. N. SPON,

35 Murray Street, New York;

OR,

W. J. JOHNSTON, Publisher and Bookseller,

No. 9 Murray Street, New York.

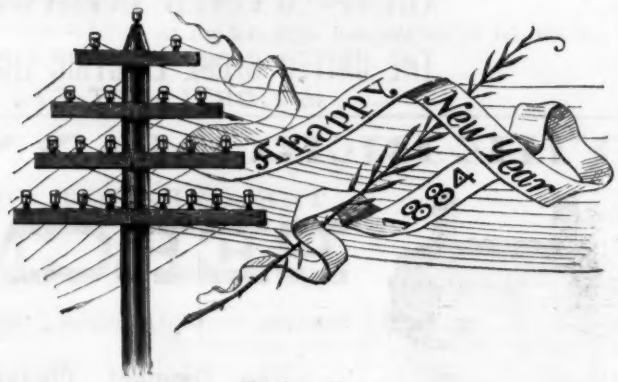
From whom copies of any book published by E. & F. N. Spon can always be obtained at publishers' prices.

NEW YEAR'S CALLING CARDS FOR 1884.

Design No. 1.

Design No. 2.

Design No. 3.



Design No. 4.

Design No. 5.

For six years past we have printed New Year's Cards for Telegraphers and Electricians. In these cards we have aimed to give the fraternity, at an exceedingly low price, distinctive New Year's Cards, neat, pretty and appropriate in style, different from any other New Year's Cards, and so unique as to attract attention and deserve preservation.

To meet the demands of all classes of electricians, we this year furnish FIVE DISTINCT CARDS, including one for **Telegraphers**, one for **Telephonists**, and one for those connected with **Electric Lighting**. The price of each style is the same.

The Cards for 1884 are not only very neat in design, but they are printed on

EXTRA QUALITY CARD-BOARD.

PRICE-LIST,

WITH NAME AND POSTAGE PREPAID.

25 Cards, any design or assorted	.....	$0.50
50 "	.....	0.75
75 "	.....	1.00

Address, or more than one name, 10c. extra.

WITHOUT NAME, POSTAGE PREPAID.

25 Cards, any design or assorted.	.....	$0.40
50 "	.....	0.60
100 "	.....	1.00
250 "	.....	2.00
500 "	.....	3.50
1,000 "	.....	6.00

Order early. U. S. postage stamps taken. Samples of the five cards mailed on receipt of 10c. Samples of the Messengers' Addresses on receipt of 2c. stamp.

Either 50 Messengers' Addresses, or 25 New Year's Cards, with name, will be mailed *free* to any one sending us two yearly subscriptions to THE OPERATOR, or one yearly subscription to THE ELECTRICAL WORLD.

The Telegraph Messengers' Greeting of the Season.

As some desire addresses for **CHRISTMAS** and some for **NEW YEAR**, we this year publish a **NEW YEAR'S ADDRESS**, and also a Greeting of the Season. The one can be used at CHRISTMAS and the other at NEW YEAR.

Both addresses are suitable for the messengers of ANY telegraph company—Western Union, Baltimore & Ohio, B. & M., the District companies, etc., as well as by messengers employed in connection with telephone exchanges. Messengers will find them neat and handsome, notwithstanding their low price.

PRICE-LIST.

25 Copies, postage prepaid, only	.....	$0.35
50 Copies, " " "	.....	0.60
100 Copies, " " "	.....	1.00
250 Copies, " " "	.....	2.00
500 Copies, " " "	.....	3.50
1,000 Copies, " " "	.....	6.00

Order early. U. S. postage stamps taken. Samples mailed on receipt of a 2c. postage stamp. Sample of both the Messenger's Address and of the New Year's Cards will be mailed on receipt of 3c. in stamps.

It will be noticed that in quantities over 100 this is a REDUCTION from the price charged in former years.

Messengers are recommended to order a supply of our Telegraph New Year's Calling Cards, with their name printed on them, to be presented in connection with the Messenger's Address.

We will send 25 addresses and 25 cards on receipt of 75c.; 50 addresses and 50 cards on receipt of $1, or 125 addresses and 125 cards on receipt of $2. Address

W. J. JOHNSTON, Publisher, No. 9 Murray Street, New York.

IN WRITING TO ADVERTISERS,

Always mention that you saw their advertisements in

THE ELECTRICAL WORLD.

Telegraph and Electrical SUPPLIES

Medical Batteries, Inventors' Models, Experimental Work, and fine brass castings. Send for catalogue **C. E. JONES & BRO. Cincinnati, O.**

It is important to us that you mention this paper.

Short-Hand Writing thoroughly taught by mail. Good situations procured all pupils when thoroughly competent. First-class stenographers furnished railroad officials without charge for my services. Correspondence solicited. Calligraphs sold. Special inducements offered operators and railroad officers. Send for COLLEGE REPORTER and caligraph circulars to W. G. CHAFFEE, Oswego, N. Y.

The Operator,

A JOURNAL OF

Telegraphic Literature, News and Miscellaneous Reading.

PUBLISHED ON

THE 1st AND 15th OF EACH MONTH.

SUBSCRIPTION, IN ADVANCE,

ONE DOLLAR A YEAR.

Postage Prepaid to any part of the United States or Canada.

To Foreign Countries the Subscription, POSTAGE PREPAID, is $1.50 a Year.

W. J. JOHNSTON, Publisher,

NO. 9 MURRAY ST REET, NEW YORK

GEO. M. HOPKINS,

SOLICITOR OF

AMERICAN

AND

FOREIGN PATENTS.

137 TEMPLE COURT,

NOS. 3 TO 9 BEEKMAN STREET,

NEW YORK CITY.

Sixteen Years' Experience.

ELECTRICAL PATENTS A SPECIALTY.

MEMORANDUM BOOK,

Containing blanks for keeping a valid record of an invention, with valuable information on patents, SENT FREE OF CHARGE.

GEO. M. HOPKINS,

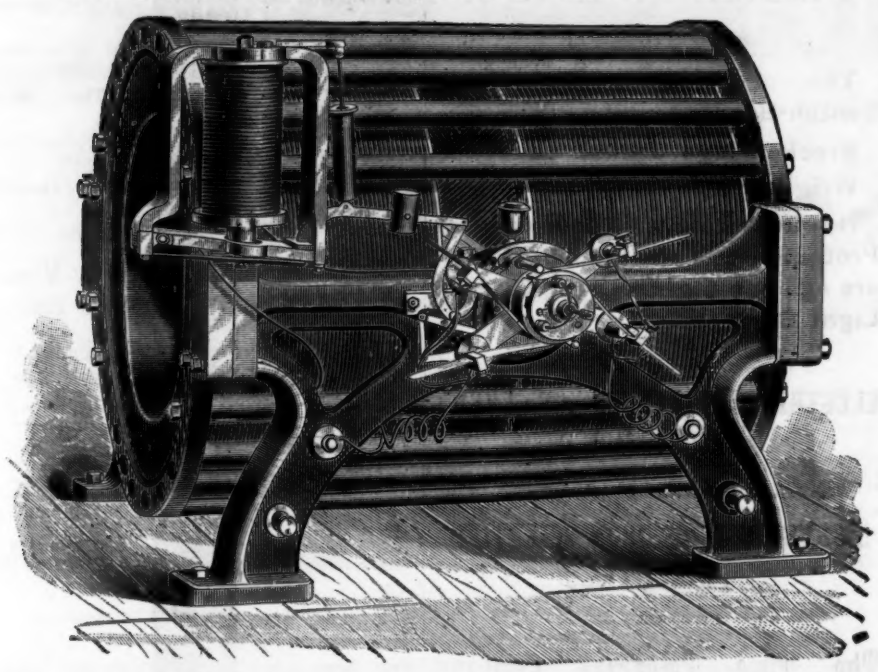
137 TEMPLE COURT, New York City.

THE

Thomson-Houston Electric Co.

FURNISHES THE

ONLY PERFECT, AUTOMATIC, SELF-REGULATING SYSTEM OF ELECTRIC ARC-LIGHTING IN THE WORLD.



In all desirable qualities of Electric Arc Lights the **THOMSON-HOUSTON SYSTEM** has no equal. The lights are superior in color and steadiness, and the entire apparatus is more economical, efficient and safe, more easily managed, and less liable to derangement than any other.

The Thomson-Houston Electric Co. has been awarded the First Prizes for

The Best System of Arc Lighting and the Best Arc Lamp

at the Industrial Exposition in Cincinnati.

Principal Office, 131 Devonshire St., Boston, Mass.

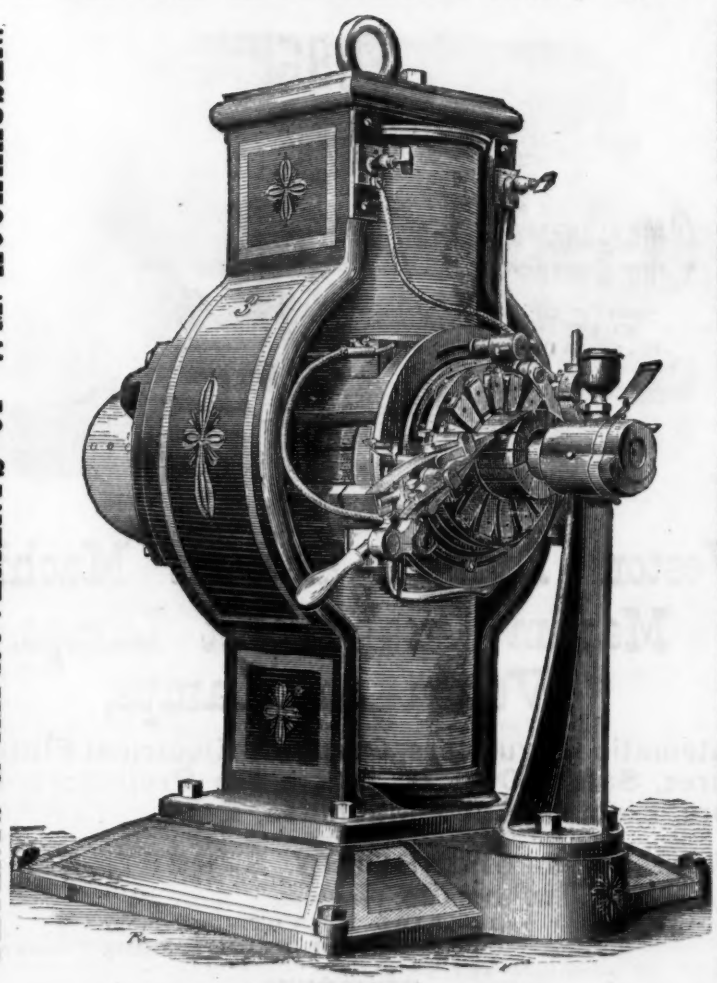
New Illustrated Pamphlet will be sent on application.

GEORGE D. ALLEN, General Manager. — THE — W. HOCHHAUSEN, Supt. and Electrician.

Excelsior Electric Co.,

66 & 68 DUANE ST., N. Y.

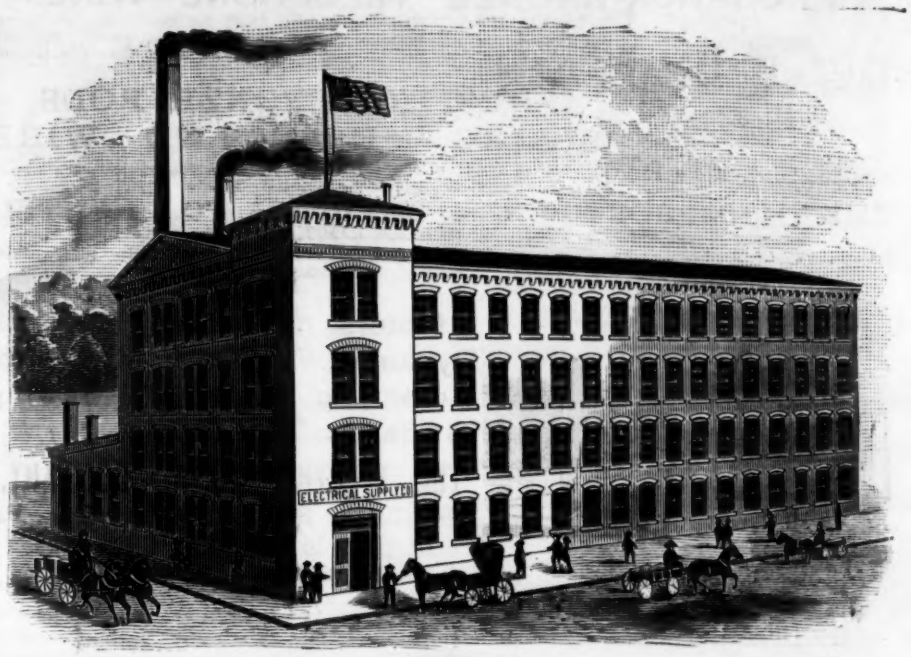
WE ARE THE SOLE OWNERS OF ALL THE VALUABLE PATENTS & IMPROVEMENTS OF WM. HOCHHAUSEN.



THE MOST PERFECT SYSTEM OF ELECTRIC LIGHTING IN THE WORLD.

Our Machine occupies the least space.
" " requires the least power.
" " has no equal in steadiness.
" " requires no attention.
Our Lamps are perfect in action as well as ornamental.

THE ELECTRICAL SUPPLY CO.



Factory of the Electrical Supply Company at Ansonia, Conn.

MANUFACTURERS OF AND DEALERS IN ALL KINDS OF

Electrical Instruments, Apparatus and Supplies.

SOLE MANUFACTURERS OF THE

"DIAMOND" CARBON BATTERY.

Perfected, improved and patented. Unequaled for Telephone or Bell Work.

PRICE, COMPLETE, $1.25.

Subject to liberal discount in quantities.

SOLE AGENTS IN THE UNITED STATES FOR

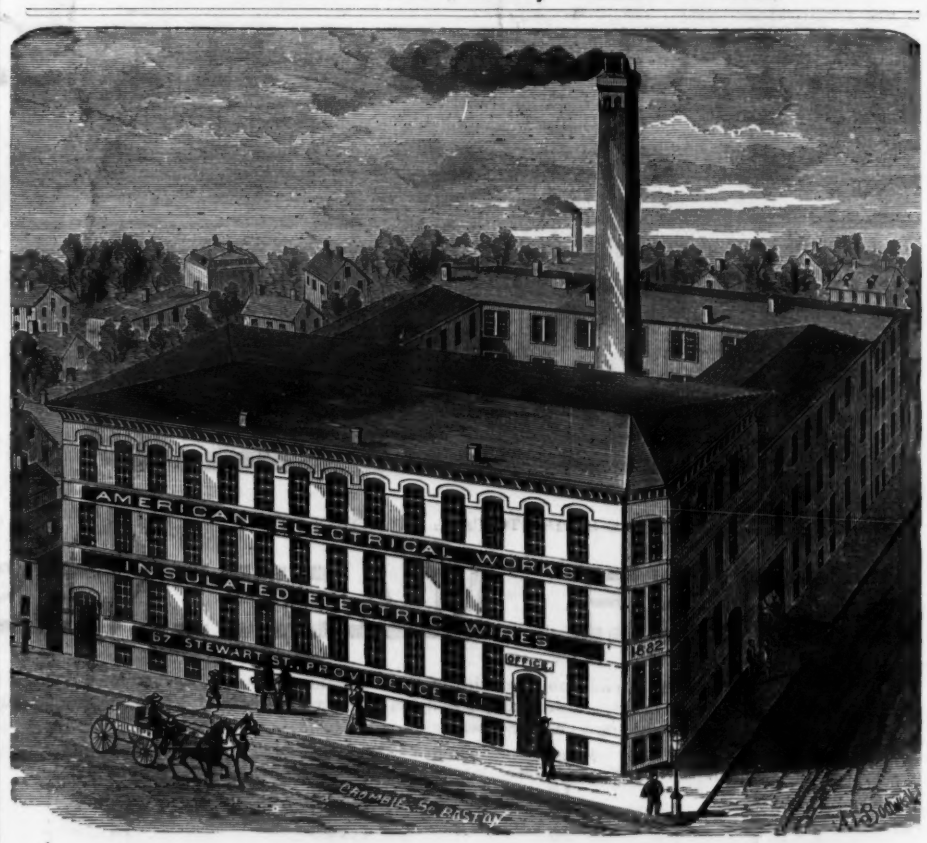
Frederick Smith & Co.'s High Grade Galvanized Iron Wire.

FROM STOCK IN NEW YORK OR TO IMPORT.

Circulars and Price Lists free. Correspondence solicited. Mention THE ELECTRICAL WORLD.

ELECTRICAL SUPPLY COMPANY,

No. 17 DEY STREET, NEW YORK.



AMERICAN ELECTRICAL WORKS,

(Formerly EUGENE F. PHILLIPS),

MANUFACTURERS OF

PATENT FINISHED

INSULATED ELECTRIC WIRES,
TELEPHONE AND ELECTRIC CORDAGE,
ELECTRIC LIGHT WIRE.

Magnet Wire, Patent Rubber-Covered Wire Burglar Alarm and Annunciator Wire, Lead-Encased Wire; Anti-Induction Aerial and Underground Cables, etc., etc.

Office and Factory, 67 Stewart Street, Providence, R. I.

EUGENE F. PHILLIPS, President. W. H. SAWYER, Secretary and Electrician.

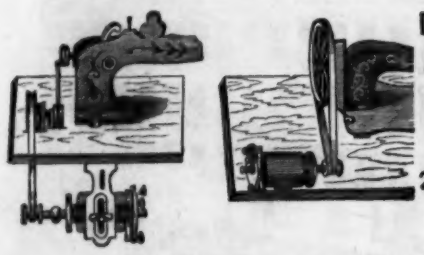
THE "ELGIN" TELEPHONE,
for Private Lines. Copied by many, excelled by none! Address for illustrated circular ELGIN TELEPHONE Co., Elgin Kane County, Ill., U. S. A. L. G. Tillotson & Co., 5 & 7 Dey St., Agents for New York.

ON TRIAL French Battery for the cure of Rheumatism, Neuralgia and Nervousness. Send for circular.
C. E. JONES & BRO. Cincinnati, Ohio.
It is important to us that you mention this paper.

PHOSPHOR-BRONZE TELEPHONE WIRE.

The STRONGEST, TOUGHEST and BEST for line wires of electric and acoustic telephones. Will not STRETCH nor RUST. RESISTS SMOKE. ACIDS and DAMPNESS. TENACITY more than FOUR times its weight per mile.

PHOSPHOR-BRONZE RODS, SPRING METAL AND WIRE,
superior to German silver or brass for electrical apparatus. Already extensively used throughout the country. Address
THE PHOSPHOR-BRONZE SMELTING CO., LIMITED
512 ARCH ST., PHILADELPHIA, PA.
Owners of the U. S. Phosphor-Bronze Patents. Sole Manufacturers of Phosphor-Bronze in the



Motors, Dynamos, Automatic Batteries.

The Only Practical Electric Motors for Family Sewing Machines.

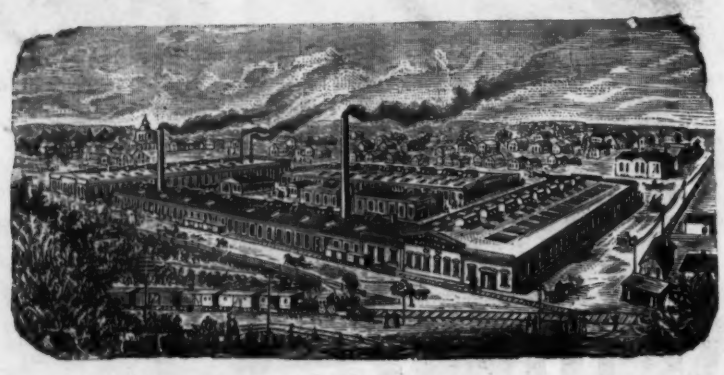
THE ELECTRO-DYNAMIC COMPANY,
224 Carter Street, Philadelphia, Pa.
19 EAST 15th STREET, NEW YORK.
SEND STAMP FOR CIRCULAR.

For Electric Lighting Unequalled.

ARMINGTON & SIMS ENGINE COMPANY
TRADE MARK
PROVIDENCE, R.I. U-S-A

For General Use Unexcelled.

ARC LIGHTS.



WE DESIRE TO CALL ATTENTION TO THE

BRUSH MACHINES

We are now manufacturing, intended to give lights of about two-thirds of the power of our usual size of arc lights. They are fully equal to the ordinary size lights of other systems, and except in the amount of light are the same in every respect as our other lights.

Number of Machine.	Number of Arc Lights.	Nominal Candle Power.	Horse-Power required.
5	10	1,200	6
6	20	1,200	11
7	30	1,200	15
8	64	1,200	35

Prices of our machines and lamps the same as our regular list. Our agents will give estimates. We shall commence this month the shipment of

BRUSH STORAGE BATTERIES

To fill the large orders which have accumulated on our books. We desire to state that these batteries are

GUARANTEED

by this Company, just as all the apparatus hitherto sold by us has been; and that the statements of our opponents regarding them, which have been so industriously circulated of late, are false in every particular.

THE BRUSH ELECTRIC CO.,
No. 379 Euclid Avenue,
CLEVELAND - - OHIO.
May 12, 1883.

RHODE ISLAND
Telephone & Electric
COMPANY,
PROVIDENCE, R. I.

MANUFACTURERS OF

The Providence Telephone Switch-Boards.
Breckenridge Jacks.
...ight Cable Clips.
...ward Safety Appliance for Protection to Telephone Subscribers against Lightning or Electric Light Currents.

DEALERS IN

ELECTRIC APPLIANCES OF EVERY DESCRIPTION.

MANUFACTURERS AND CONSTRUCTORS OF

LIGHTNING RODS UPON SCIENTIFIC PRINCIPLES.

LICENSEES OF

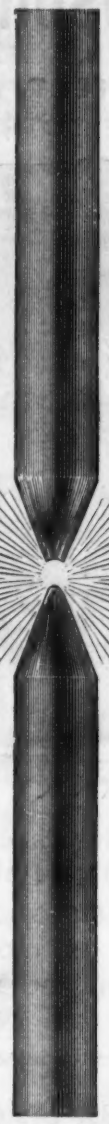
The Time Telegraph Company
OF NEW YORK,
FOR THE NEW ENGLAND STATES.

Energetic Men With Capital Wanted,
TO FORM LOCAL PLANTS IN TERRITORY NOT YET DISPOSED OF.

Correspondence solicited from inventors, or parties having electrical novelties, with a view either to purchase or introduction as agents.

HENRY HOWARD, Pres.
C. T. HOWARD, Sec. and Treas.
J. W. DUXBURY, Gen. Man.
F. H. GARDINER, Asst. Man.

Boulton Carbons.

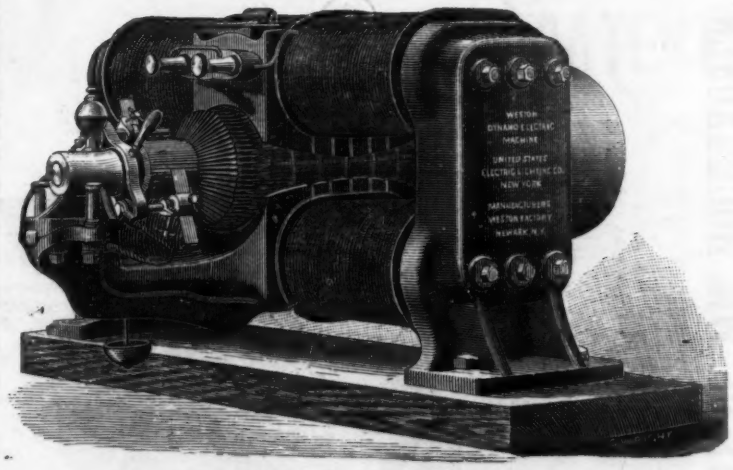


These carbons are made of the best materials, and with the latest improved machinery, of any required degree of hardness, and can be used in all makes of Electric Lamps. The regular sizes, 12 inches long, run from ⅛ inch to 1 inch in diameter, varying by sixteenths and sizes and complete to order. A large stock always on hand.

The want of a high order of battery plate has long been felt. Those wishing such would do well to use the **Boulton Plates.** Special attention is given to the manufacture of all sizes to order. Price-Lists and full information furnished on application.

BOULTON CARBON WORKS,
990 Payne Avenue, Cleveland, O.

The United States Electric Lighting Co.,



MANUFACTURERS OF

Weston Dynamo Electric Machines,
Maxim Incandescent Lamps,
Weston Arc Lamps,

Automatic Regulators, Carbons, Electrical Fittings and Fixtures, Safety Devices, Steamship Projectors, Electric Motors, Electroplating Machines, Etc.

Office: 59 & 61 LIBERTY STREET, New York.

GEORGE W. HEBARD, President.
LEONARD E. CURTIS, Secretary.
PH. FERD. KOBBE, Treasurer.

TRUSTEES:

MARCELLUS HARTLEY, ANSON PHELPS STOKES, CHARLES R. FLINT, LOUIS FITZGERALD, EDWARD WESTON, WALTER T. HATCH, HENRY DAY, GEORGE W. HEBARD, THOMAS H. HUBBARD, HENRY B. HYDE, JOHN A. STEWART, ROBERT B. MINTURN, LEONARD E. CURTIS.